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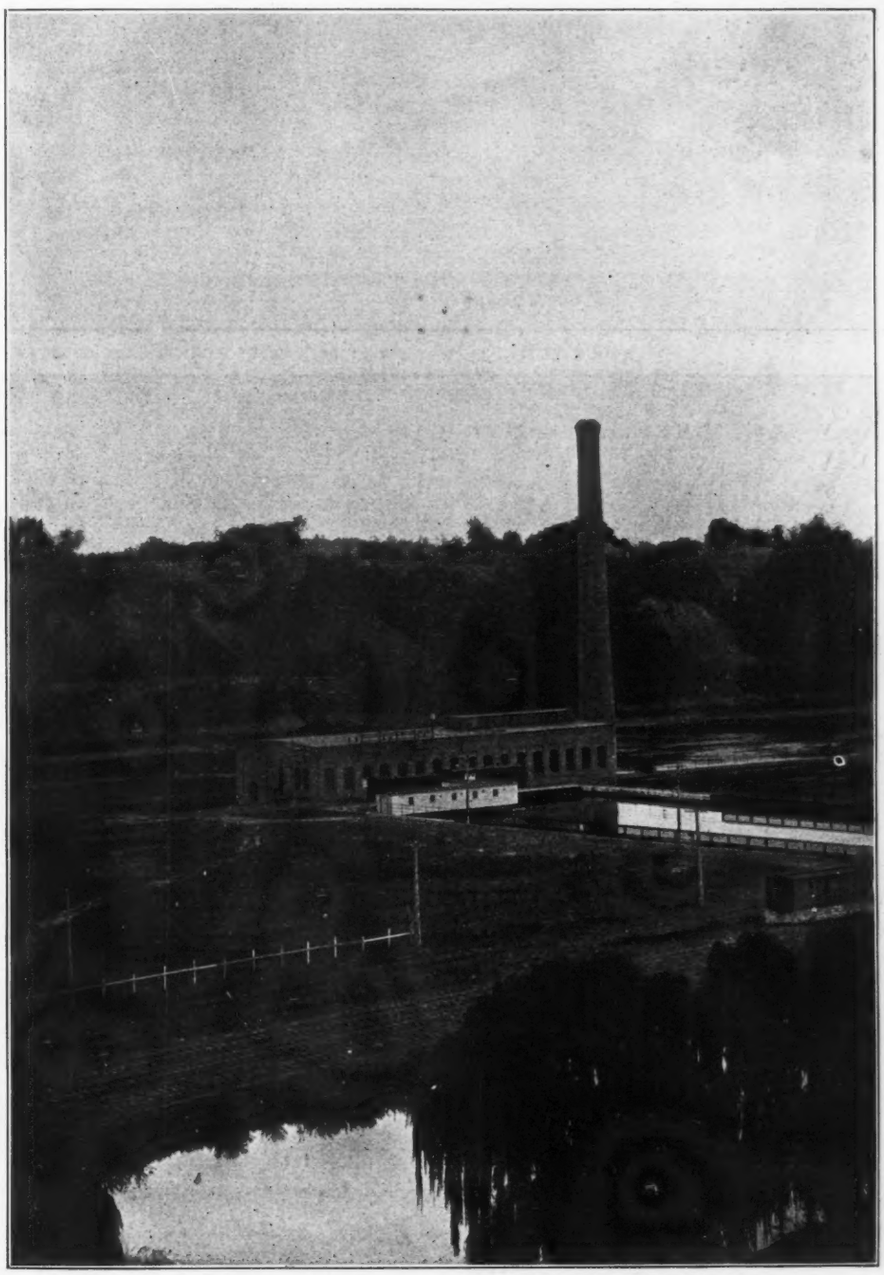
Steam Turbine and Water Power Plant at Holyoke. Mass.

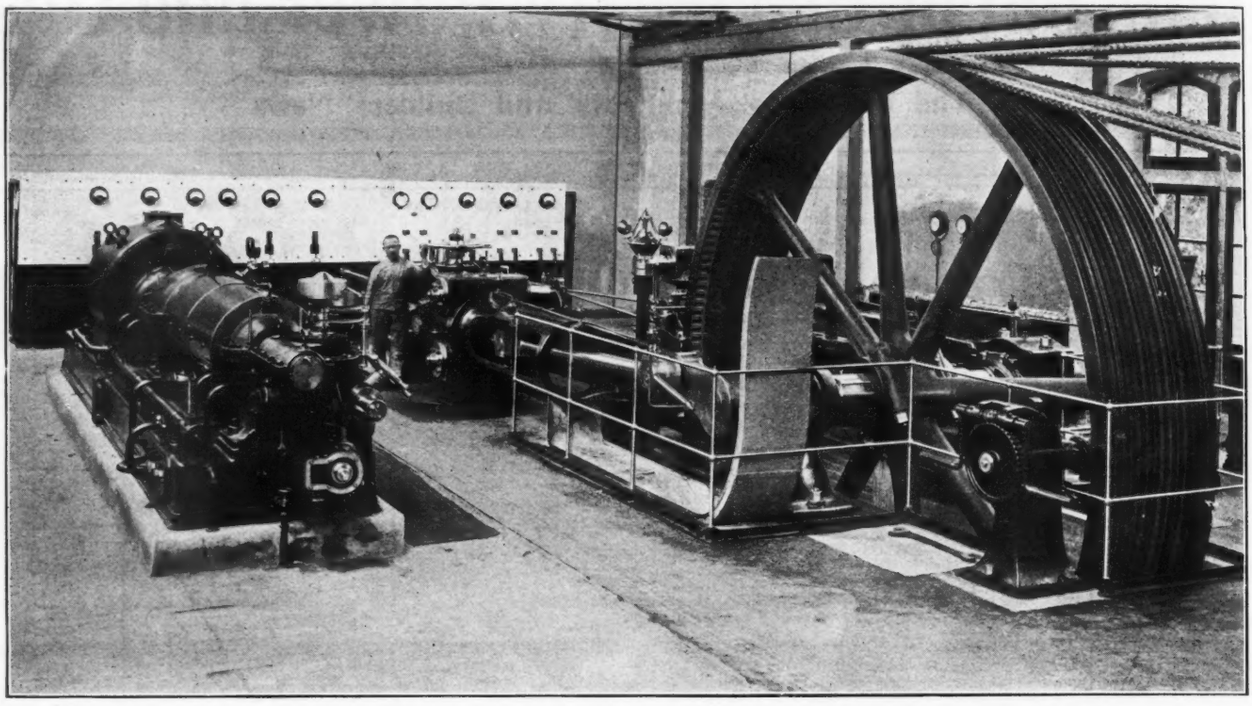


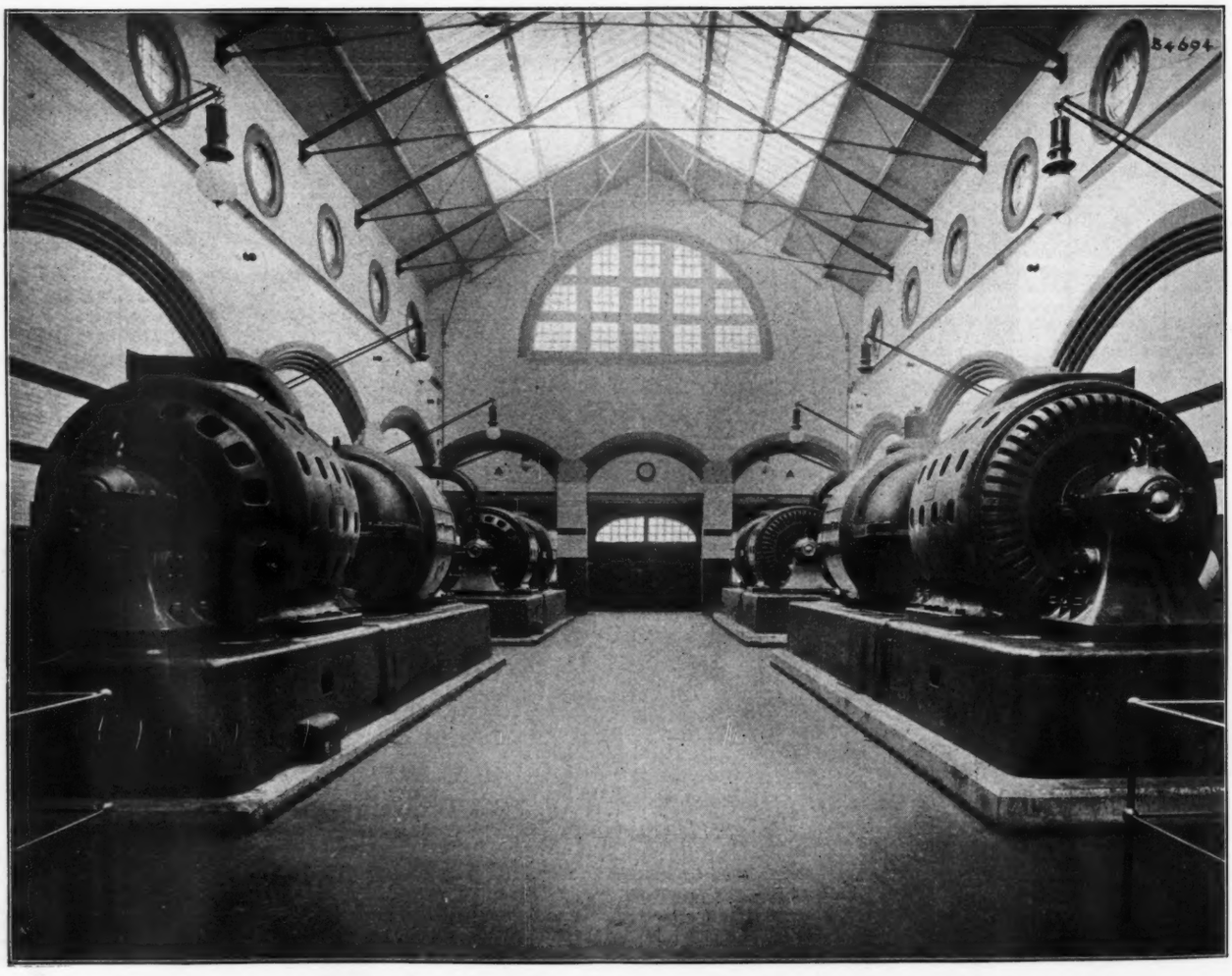
POWER HOUSE, INTAKE, CANAL, HEADGATES AND FOREBAY

Steam Turbine and Water Power Plant at Holyoke, Mass.

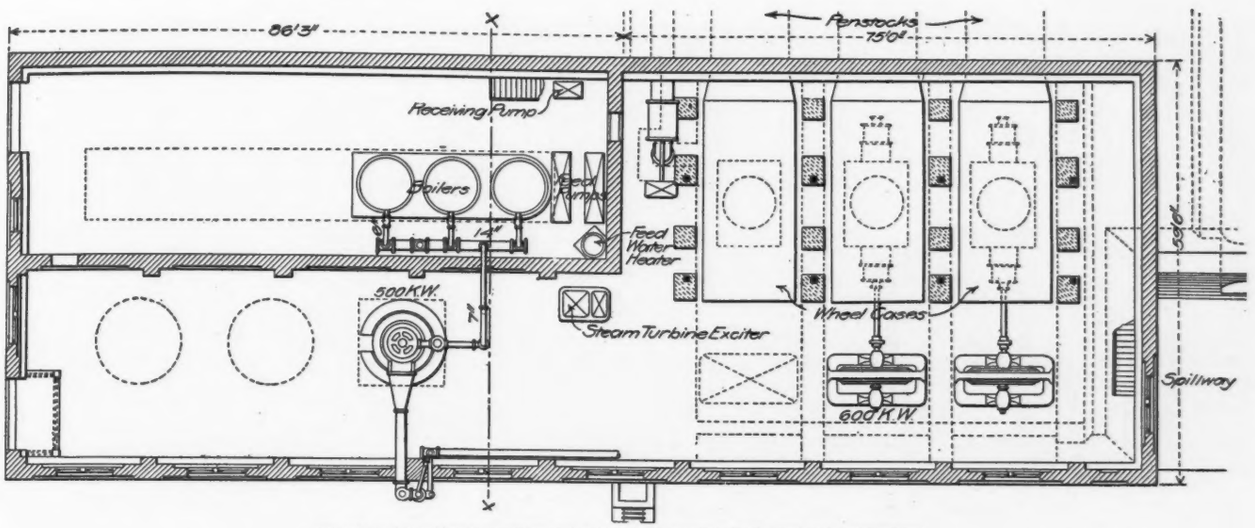
ON OPPOSITE PAGE

1200-Horsepower Steam Turbine and Reciprocating Engine, Showing the Comparative Space Occupied by These Two Types of Prime Movers





10,000-Horsepower Municipal Steam Turbine, Showing Two 2000-Kilowatt and Two 1600-Kilowatt Westinghouse Turbo-Alternators.



PLAN OF STATION BUILDING AND ARRANGEMENT OF MACHINERY

The electric power development of the Holyoke Water Power Co. has recently been completed. Water from the Connecticut river is used for the development of power, and in addition there are to be installed in the station three vertical Curtis General Electric steam turbines. The Connecticut river above the stone dam drains an area of approximately 8,000 square miles, and the ordinary flow of the river is in excess of 10,000 cubic feet per second. At this point there is a total possible hydraulic development of not less than 75,000 horsepower. The conditions existing during floods, however, are such that the effective head is reduced approximately 20 feet, and it is therefore necessary to have an auxiliary steam plant. The present development is small, but is quite sufficient for the needs of Holyoke at the present time.

The power station building is constructed of brick and steel, and has a total length of 160 feet, is 60 feet wide and two stories in height. There are two twin water wheels in the plant, each having an output of 1,000 horsepower. These wheels are directly connected to three-phase alternators, having a capacity of 600 kilowatts at 2,300 volts. Provision has been made for a third unit of the same capacity.

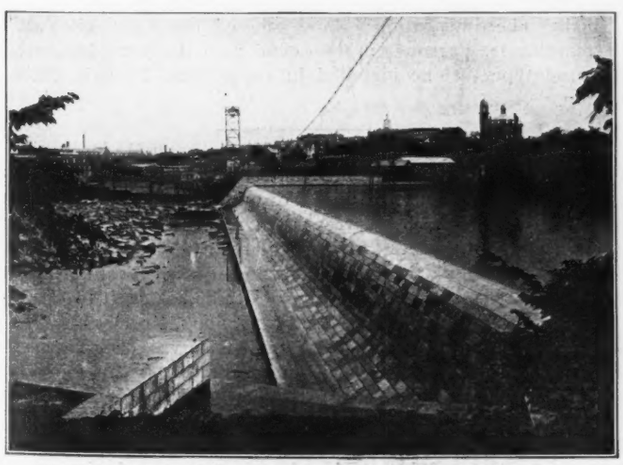
The canal is 10 feet deep and 80 feet wide on the bottom, increasing to 120 feet in width near the intake. There are four penstocks connecting the power plant with the headgates at the terminus of the canal, three of which are 11 feet in diameter, and the fourth 3 feet in diameter, the latter one supplying water to the exciter unit. These penstocks are 75 feet in length and connect with the water wheel cases, each of which are 30 feet long and 13 feet in diameter. The water wheels are of the McCormick type, 43 inches in diameter, and discharge into the raceways through draught tubes, the water being delivered to the river below the dam after passing through the wheels. The ordinary river level is such that the static head is 32 feet. An overflow is provided at the terminus of the canal, in addition to the head gates, of granite masonry with four wicket gates 4 feet square, the spillway being 75 feet in length.

Removable flash boards make it possible to increase the depth three feet. The capacity of the spillway is about 4,000 horsepower, which is sufficient to supply power to about sixty of the mills in operation in Holyoke.

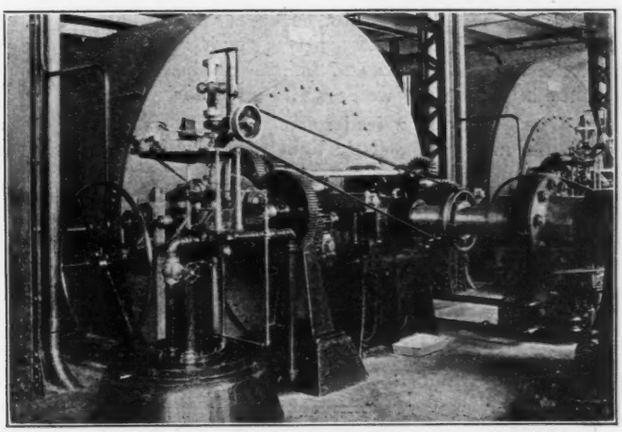
Each penstock is provided with a 20-inch cast iron pipe to eliminate air pockets. Special care has been taken to provide against slush ice in winter, and it is thought that there will be no difficulty arising from this cause, as arrangements have been made to shunt the ice into the river through a spillway, thereby avoiding any clogging of the wheels from this cause.

In the western part of the power station building is located the auxiliary steam plant. The boiler plant consists of three vertical Manning boilers, manufactured by the Holyoke Steam Boiler Works, each having a capacity of 200 horsepower. Bituminous coal is used, costing $4.00 per ton, and end fired, rocking grates are installed in the furnaces.

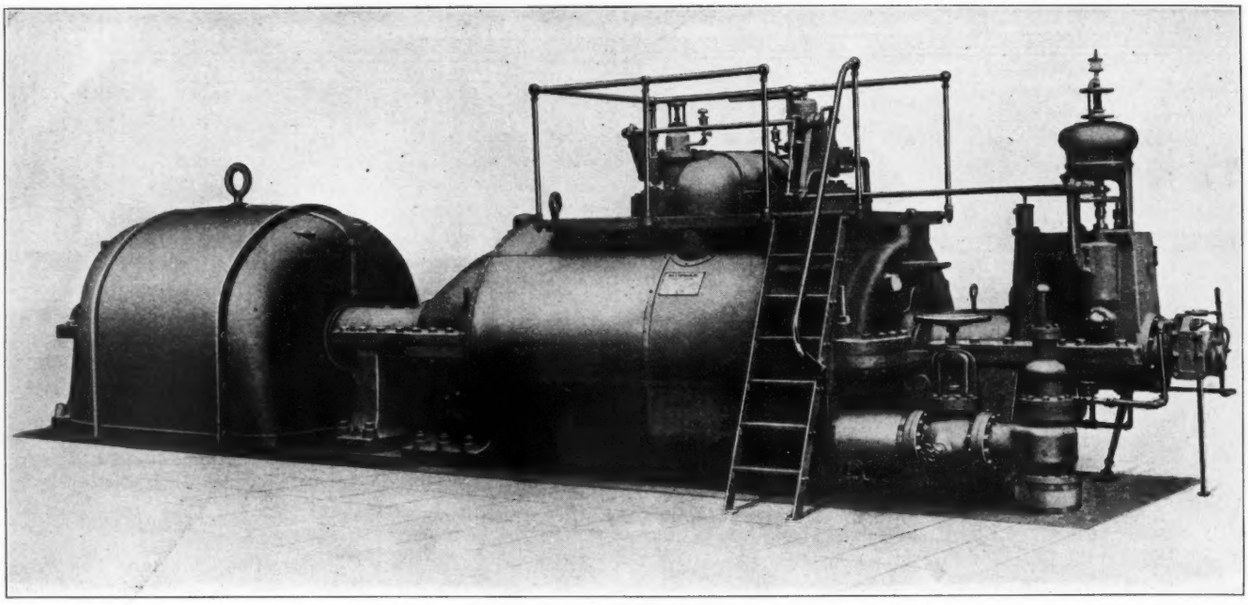
The storage pit for coal will contain 2,500 tons, and the fuel is delivered to the boiler room by means of narrow



DOWN STREAM—FACE OF MASONRY DAM



LOMBARD GOVERNORS AND METHOD OF OPERATING WATERSHED AND GATES



1,000 K. W. INCLOSED TYPE WESTINGHOUSE-PARSONS TURBINE

gauge charging cars, from which the coal is thrown directly into the furnaces. The boilers are connected with the brick stack, which is 75 feet in height.

Feed water is ordinarily supplied from the city water works, and also water for condensing purposes. There are, however, two feed pumps installed by which water may be pumped from the canal or river if desired.

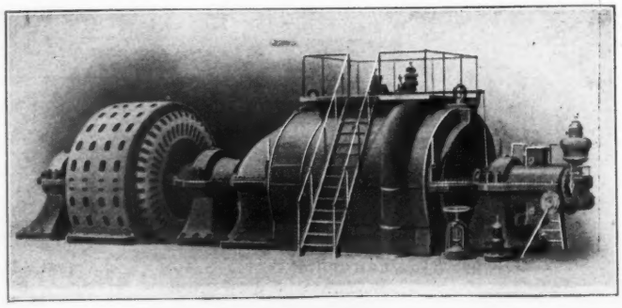
A duplicate system of steam pipes is provided with a main header for the three 500 kilowatt Curtis turbo-alternators, only one of which, however, is now in operation. An extra heavy steel pipe, 14 inches in diameter, is used for the main header, from which branches 6 inches in diameter lead to the boilers and also to the turbines.

The speed of the turbo-generator is 1,800 revolutions per minute and is provided with a mechanically operated governing mechanism, and the unit is guaranteed to have a capacity of 50 per cent above normal rating. The turbine unit exhausts into a Bucklay 1,000 horsepower condenser just outside of the station. The turbine is connected to the condenser by pipe 16 inches in diameter, which is equipped with an atmospheric relief valve located at the top of the exhaust riser. In this way it is possible to exhaust directly to the atmosphere in case of accident to the condensers.

The cables from the generator to the switchboard are carried through iron conduits embedded in the cement floor.

A No. 000 paper insulated copper cable is used for the alternator mains, while No. 00 copper is employed for the field coil connections. A separate conduit has been installed for the field coil wires and for the conductors of the small motor in use on the water wheel governor.

One of the main feeder lines connects the power house with the municipal electric light plant switchboard in order to provide auxiliary power during heavy load to the municipal lighting system. A second feeder circuit connects the power station with the paper mill at South Hadley, a distance of four miles from the Holyoke power plant. For this transmission the voltage is raised to 6,600 volts by three oil-cooled 75 kilowatt transformers. The switchboard at the power house has in addition to the tree panels required for the above-mentioned feeders, a second set of three panels, which, however, are not provided with switches, but will be equipped when the demand for power increases. Push button switches are located on the main switchboard for controlling the water wheel governors, and there by regulating the 600 kilowatt 3,200 volt three-phase alternators.



1,000 K. W. WESTINGHOUSE-PARSONS TURBINE

Another interesting turbine plant which is in use with a water power electric system is that of the Los Angeles Edison Electric Co. A 7,500 kilowatt Westinghouse, Parsons steam turbine has recently been installed in this plant by the firm of Hunt, Mirk & Co. of this city. This unit has but recently been put in operation and the generator runs in synchronism with the water wheel generators in the various water power plants of the company.

One of these plants is the installation in the Santa Ana canyon containing four 750 kilowatt alternators. This power is transmitted a distance of 83 miles at 33,000 volts to the sub-station in Los Angeles, where the new turbine is installed. The illustrations show one of the 1,000 kilowatt Westinghouse, Parsons turbines, and also the 7,500 kilowatt enclosed type turbine installed in the Edison Electric Co.'s station.

The pamphlet entitled "Results of Tests Made in the Collective Portland Cement Exhibit and Model Testing Laboratory of the Association of American Portland Cement Manufacturers," which was reprinted recently from the proceedings of the Association of American Portland Cement Manufacturers and the American Society for Testing Materials, contains much information of decided interest to those engaged in cement or concrete construction. Besides the details of numerous tests on concrete cubes of various composition, and on four experimental beams, three according to the Hennebique system and one according to the Kahn system, the pamphlet gives the results of elaborate tests on beams built according to various other systems in use in this country, besides tests of floor slabs of 15-foot span and of a reinforced concrete cantilever. The methods of reinforcement are shown by diagrams.

A GAS ENGINE INSTALLATION IN NEW ENGLAND.

At the September meeting of the New England Street Railway Club an interesting talk on gas engines as prime movers was given by Mr. Paul Winsor, chief engineer of motive power of the Boston Elevated.

In discussing the gas engine problem informally, Mr. Winsor stated that for several years it has been his opinion that the gas engine is the coming prime mover. Few steam plants show a better efficiency than 3 pounds of coal per kilowatt-hour, but the Boston Elevated's plant at Somerville has averaged less than 1.5 pounds of coal per kilowatt-hour for all coal consumed in regular service runs since May 2, 1906. This great economy in fuel is obviously the chief advantage of the gas engine plant. The chief trouble has been the noisy exhaust, but this is being remedied gradually. The Somerville plant has been operated sixteen hours per day in commercial service, beginning at 7 a. m. and shutting down at 11 p. m. The plant has been shut down only when power was not wanted, or when slight adjustments had to be made, incidental in getting a new installation in running order. The Medford plant was not ready quite as early as the Somerville station, and only one engine has been operated so far, as the company wished to reduce the noise as much as possible before inaugurating regular operation in the residential district where the station stands. It is expected that the station will become practically noiseless in due course. The fuel economy of the plant is the great point of value. It has been difficult as yet to obtain a correct idea of the labor cost of turning out power. It is at present rather high, but should compare favorably with a steam plant in the long run. Mr. Winsor then exhibited several drawings of the gas engine cycle, and discussed the features of the four-stroke cycle and also the cycle in which the engine does work in one stroke per revolution. Many engines are made with tandem coupled cylinders, corresponding in performance to a single cylinder steam engine. At the Medford plant gas and air pumps are mounted on the engine.

Discussing sources of fuel gas, Mr. Winsor emphasized the excellence of illuminating gas, but pointed out the objection of its high cost. As made by distilling coal heated in a closed retort, it has a thermal value of about 600 B. T. U. per cubic foot. Natural gas is admirable where it is available, and it has a calorific value of about 1,000 B. T. U. per cubic foot. The cheapest gas is that of the blast furnace, but it has a thermal value of only about 80 or 90 B. T. U. per cubic foot, and is very dirty. Producer gas is made, generally speaking, by burning live coal in a closed chamber on top of a bed of ashes. Air is forced in beneath the bed or drawn in by a blower on the discharge side of the producer. The producer has a double top. The chemical reactions are relatively simple.

In a soft-coal producer plant hydrogen and tarry matter are distilled at a fairly low temperature. The tar must not go into the engine, so it must be separated from the gas if soft coal forms the basis of operations. This process is called scrubbing, and it consists of passing the gas through a vertical tank in which are suspended horizontal trays of coke, over which water runs. The suction of gas can be run by the engine if desired; the suction stroke of the piston in such case draws the gas through the producer and into the cylinders. The West Somerville plant is at present at something of a disadvantage in regard to ashes removal. The cleaning of the producer and removal of ashes has to be done when the plant is shut down, as the producers are installed in a unit pair. Both must be in operation at the same time.

This plant is equipped with a rotary blower which draws the gas from the producer to the engines. With soft coal the tar passes in this type of producer down through the hot coal and then passes off as a permanent gas. The company gets a large quantity of lamp black in the operation of its plant at West Somerville. It is separated by spreading it out and allowing it to dry. With this form of producer one can always see the fire. The drawback is the difficulty of cleaning. The fire is too hot for shaking grates and it makes a bad clinker unless cooled by a steam jet.

Few steam plants give an efficiency of 10 per cent from the coal. About double this can be obtained in a gas plant. In a producer plant about 25 per cent of the heat of the coal is lost, and about 30 per cent in a steam boiler installation. The principal losses in the gas plant are in the engine water jackets (25 per cent) and in the exhaust (30 per cent). The largest loss in the steam plant is the latent heat of the exhaust steam, as it is condensed.

The Somerville plant never requires over 15 or 20 minutes for starting up. If it were shut down 24 hours it might take 30 minutes to commence operation. Thus far the principal troubles have been oil troubles. The quantity required was excessive, and the capacity of the filter was insufficient. This is being remedied, but on account of the large surface to be lubricated it is doubtful if the oil consumption becomes low. A good many premature explosions and miss fires have been noted, but the conditions are now improved. A rocker shaft was broken and a few mechanical difficulties were experienced, but more hours of work have so far been gotten from this gas plant than from a turbine installation which the company is inaugurating. Mr. Winsor closed by exhibiting some graphic examples of the energy loss in the different parts of a steam and a gas plant.

GROWTH OF TELEPHONE SERVICE IN NEW YORK CITY.

A bulletin has just been issued by the telephone companies operating in New York City which shows that the gain in telephones for the month of September was 7,584. This brings the total number of telephones in service and under contract up to 276,000 telephones, or approximately one telephone to every fourteen persons in the city. Comparison with other cities proves that no other city in the world has half as many telephones as New York. The company attributes this ever increasing gain to the fact that with every telephone added to the system the value and scope of the service is increased to each user—in other words, as the size of the system and the number of subscribers increase, it becomes more and more important for each and every person to have a telephone. If the present ratio of growth keeps up, there will be 600,000 telephones in New York City in 1910.

CONSTRUCTION NEWS FROM THE NORTH.

It is officially announced that the Inland Empire Railway Co. will extend its line to Lewiston, Idaho, thus giving Spokane connection with the Snake river. This company will also extend its line down the Spokane river to the power plant which is being constructed at Miles Bridge under the supervision of A. L. Zimmerman of Philadelphia.

The Spokane & Big Bend Electric Railway Co. of Spokane, which was organized to build a road from Spokane to Davenport, a distance of 120 miles, has purchased 90 miles of the right of way. Surveys have been completed, and the president, Mr. W. H. Plummer, announces that the road will be in operation before June.

The Northern Pacific Railway Co. announces that it will operate an electric railway over the old Union Pacific grade between Portland and Tacoma, which is 145 miles long.

The Willamette Valley Co. has begun the construction of a line between Salem and Mehama, Ore., a distance of 25 miles.

The United Railway Co. will build 100 miles of new lines in and outside of Portland, Ore.

ORGANIZATION AND CONDUCT OF A NEW BUSINESS DEPARTMENT SUITABLE FOR CENTRAL STATIONS IN CITIES OF 50,000 POPULATION, AND UNDER.

(By Charles Nathan Jackson.)

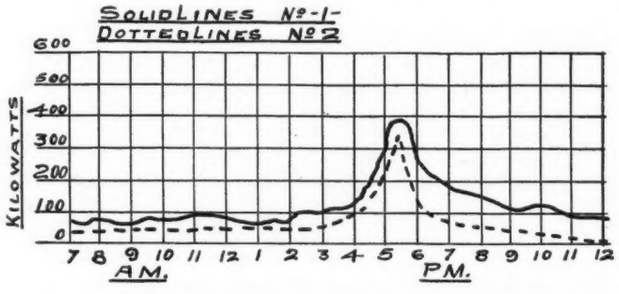
I have always lived in the small city of "C," a town of about 30,000 inhabitants, in central Ohio. I have been in the banking business for several years, and was interested, to a certain extent, in our local electric light plant. In course of time, however, I purchased the entire property. The former officers of the company had always been satisfied to let well enough alone, and, as the plant was paying a small dividend, they were not very aggressive. I determined to see if, by increasing the business, I could increase the net earnings of the property.

We had a total generating capacity of 600 kilowatts and did not do municipal lighting. The revenue was about $30,000 per year, and the plant was loaded to its utmost capacity about 5 o'clock in the December afternoons. The manager in charge was a very capable operating man and had several years of experience at operating plants. He was drawing a salary of $2,000 per year, but did not seem to know much about hustling the business. When I asked him what we had better do to increase the revenue, he said: "Hire a solicitor and install more machinery." We finally secured a young man who had sold electricity in another town, and started him to work and then began to make plans for increasing the capacity of the plant. We were charging 10 cents per kilowatt hour, and the young man had not been at work very long before he secured a contract for a wholesale house that would use about 25 arc lamps. He also got contracts for several factories, and I began to think that there was a good prospect of his building up quite a business. However, I did not see any increase in the receipts, but the manager told me to wait until next winter and all these new customers would then be using the light. Of course, we could not expect much in the summer, as they did not need it. Gas was selling at a dollar a thousand cubic feet, and a walk through the business district at night showed all saloons, drug stores, restaurants and hotels using gas. Upon inquiry I found that the price of electric light to such consumers was about three times the cost of gas, and of course they could not afford to pay the difference. The solicitor's business soon began to drop off and in a few months his orders were very few and far between. He merely said that he had secured every customer that he could, and could not possibly get any more.

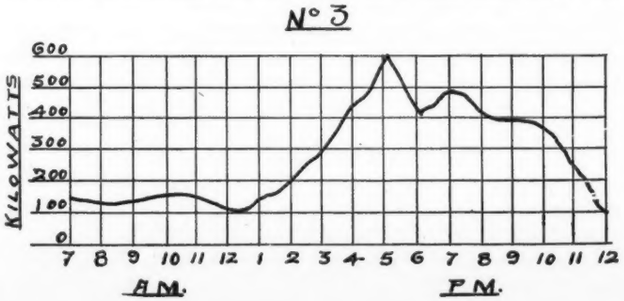
In other cities I have seen the electric light company light all the saloons, drug stores, etc., and wondered why we could not do it. So I began to look around and see if I could not find a man who could get the business. One day, in answer to one of my letters, Mr. Johnson, a man of about thirty-five years, called to see me, and in answer to my question as to what he could do, he replied that he did not know, but that if I would give him a guide and a right to ask a few questions, he could soon tell me. I did so, and the next day he returned and said, "I find that you have loaded your plant down with 'short burners.' About the only revenue you get is on the peak in the winter. You asked me how I could increase your net profits, and I will say that I can increase your net profits from twenty to thirty thousand dollars per year, and you need not purchase any more machinery." I replied that I did not see how that was possible, as we could not raise our prices. He said that he would cut them to some customers and raise undesirable ones. "For example, you have a commercial light and power load of 600 kilowatt on the peak, or a revenue of fifty dollars per year, per kilowatt demanded on the peak. Now, there are a great many concerns, such as saloons, drug stores, restaurants, hotels and other 'long burners' that you ask to pay at your present ten cent rate, $200 per year, per kilowatt demanded, which is much too high. Imagine a drug store having forty 16-candlepower lamps, paying you $400 per year; their gas bills are not over $150 per year, but you will let a wholesale store that closes at 5:30 burn forty 16-candlepower lamps and only pay you $50 per year, and they cost you nearly as much as the drug store. All of your fixed expenses are the same for both, but the drug store uses about 4,000 kilowatt hours, and the wholesale store, 500 kilowatt hours. As your coal bill is not over one-half cent per kilowatt hour, you can see the drug store would cost for coal, $20; the wholesale house, $2.50. So you are either making a very large profit on one or losing a lot on the other."

I could readily see that this argument was correct, and asked him how he would go about it to produce results. He replied that the town was not large enough for him to spend his entire time with us, but that he had in training several bright salesmen, any one of whom was capable of going into the town and working up the business under his supervision. Of course, it would oftentimes be necessary for him to help the solicitor on some big contract, and that he would charge me $1,800 per year for the services of the solicitor, and for his own services he would ask 25 per cent of the increased profits during the first two years. After that he would probably not be needed, as things would be running so nicely that the solicitor would be able to go it alone.

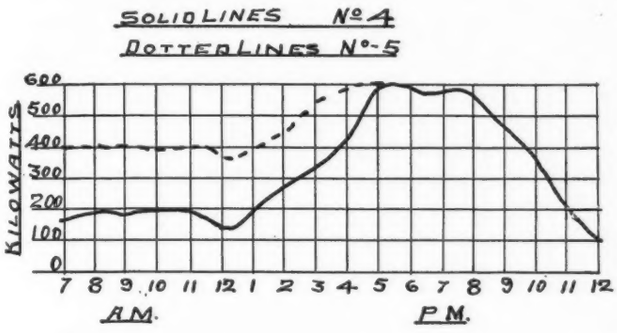
His desire to back up his ability with such a proposition made me feel safe in accepting it at once. He at once came on the ground to give us a start, and first got a friend of our company to agitate a rate ordinance, which was passed. It prohibited a charge in excess of fifty cents per month, per 16-candlepower lamp to customers using light not over ten hours per day. The "long burners," of course, were pleased and boosted it along. The "short burners," never dreaming that it would affect them, said nothing. He then sent for the solicitor, who was instructed to charge a flat rate of $5.00 per month, per kilowatt demanded, and an extra charge of two cents per kilowatt to all light customers, except residences, who were to pay ten cents per kilowatt hour, $1.00 minimum. Lodge rooms, churches and hotels were to receive a special rate. The solicitor had no trouble in securing contracts with all the "long burners," and, at the same time, kept an eye open for unprofitable "short burners," and raised their price to the new rate. The wholesale house when asked to pay ten dollars per month plus two cents per kilowatt hour, threw up their hands in horror, and said that they would not stand for any such "hold-up." So they put in gas.



In October the load curve of the station looked like No. 1. The load curve before looked like No. 2. He said, "You will notice that the load drops off a little after six; if we



don't do something we will have a curve like No. 3 in December. You will notice on No. 3 that it will begin to drop off at 5 p. m. I am going to start a strong campaign on residence lighting, churches and lodge rooms, which commence to burn at 5 o'clock and get heavier as the other load goes off. He engaged two bright young fellows and started them after residence contracts at the old price of 10 cents per kilowatt hour. They would turn the names of all prospective customers over to a stenographer, who would mail them a series of letters and advertising matter on electricity for home use. In that manner they would get from two to four contracts per day. All that time the solicitor was getting all the churches and lodge rooms he could, at a 6-cent rate. It was not long before I could see a change in the load curve. It began to fill out after 6 and by Christmas it looked like No. 4. He was not satisfied with that, but said he wanted one



to look like No. 5, and that he would get it with power business. I replied that factories did not stop work until 5:30, so their load would be on the peak. He said that large factories are on the peak, but small shops are not. He had studied their load and found that a load curve from a power circuit handling a great many large and small customers showed a load curve during December that began to drop off at 4 o'clock and reached zero at 6, and at 5 o'clock it was only 50 per cent of the total load, and that there were several large factories which he knew were on at 5 o'clock, consequently it must have been the small shops that began to quit at 4 o'clock and were practically all through at 5.

He began to push power business at 3 cents to large and small customers alike. As there was no firm in town that handled motors, we sold them to our customers at cost. Such a low price on power secured a great many small power customers and a few large ones. He was gradually filling up the "valley" in the load curve, and our receipts in March were $5,000, which made me feel pretty good. About that time a big cold storage plant was being built and Johnson went after the business, quoting a 2-cent rate. He told me that they would require 100 horsepower about 600 hours per year, which at 2 cents per kilowatt hour would give us a revenue of $9,000, of which about 75 per cent was clear profit. I had so much confidence in Johnson that I knew he was right, but I had to ask how the profit could be so much and how he could carry the increased load. "Nothing easier," he said. "They agree not to use power after 4 p. m. in November, December and January, so the only time they come near our full load is Saturday night in the summer time, and then our load is never more than 400 kilowatts. Regarding the 75 per cent profit, I am going to let you answer that. Do you have to put in more machinery to carry the load?" I replied "No." "Do you require any more men to run your plant?" I said "No." "Then isn't coal the only added expense and does it cost you over ½ cent per kilowatt hour?" I took off my hat to him. I could see his 75 per cent profit.

When summer came, our receipts held up to about $4,000 per month. All the stores were paying their "flat rate." The power customers were paying more than they did in the winter, the refrigerating plant was paying us nearly a thousand dollars a month, and I began to see visions of a good paying property.

Johnson had an office system that was very thorough and yet very simple. He first bought one section (two drawers) of a vertical filing cabinet. The folders were numbered from "one" up. He had another drawer in which he kept his 3x5 index cards. When a new contract came in, a work order was issued in quadruplicate (two heavy copies and two tissues), one tissue was put in the customer's folder and the two heavy copies and the other tissue went to the operating manager, who kept the tissue and passed the two heavy copies to the line foreman and the meter foreman. The operating manager's tissue was kept on his desk, so that he could see what orders were in the hands of the men. When the men returned their copies marked "completed," he destroyed his tissue and passed the order back to Johnson, who passed them with the contract to the bookkeeper, who would enter customer's name and rate on the ledger and then would pass them back to Johnson, who filed them in the customer's folder. He issued work orders for meter tests, complaints on service, etc., to the operating department in the same way, always filing his tissues at once, so at any time a glance in the folder would tell what the last move was. All prospective customers had a folder. After a visit, where anything of importance was said or done, he would dictate a "report" and file it. He also had a small desk tray, which he called the "tickler." One set of guides were for the twelve months and one set for 31 days. I have seen him dictate a report on a prospective customer, saying that if Jones & Co. renewed their lease December 1st they would be glad to accept our proposition of April 15th. He would then drop a 3x5 tickler card in the tickler for about December 1st calling attention to report of April 15th on Jones & Co. He never tried to remember the slightest thing regarding any deal. If it were "up to the other party" he paid no attention to it and never gave it another thought. If it were "up to him" he would put in a tickler that would come up, say in ten days, asking if "Davis & Co. had answered June 12th," or "had P. C. Stewart sent him plans as per May 29th."

One day I asked him how a certain big power deal was progressing. He looked in the folder and found that the last thing done was a letter confirming a verbal quotation. It was signed by the solicitor, and we, to test the solicitor's system, looked in the tickler to see if he was taking care of it. We found a tickler dated eight days from the date of the letter, asking if the Iron Works had answered May 17th. He taught his solicitors never to use their memory, but to keep the system in first-class shape. He said that a good man could solicit at one time 50 large deals whose business would run from $3,000 to $20,000 per year, and can tell any detail of any one of them in a very few minutes. After a call on a prospective customer he would decide when he would call again, make his notes and then forget that such a deal is on.

There were about 15 deals which he gave his personal attention in our town. I have seen him come into the office after a week's absence, look at a small memo book and say: "I must see Brown & Co. this trip." I would ask him "how about the others." He knew no "others." He only knew those that turned up for that trip, and under no circumstances would he go near any other deal.

He trained his men never to say anything while on a deal until they got all the information they could, then to go away and "form a plan of campaign," and when they got a plan that looked good to them, "go ahead and work it."

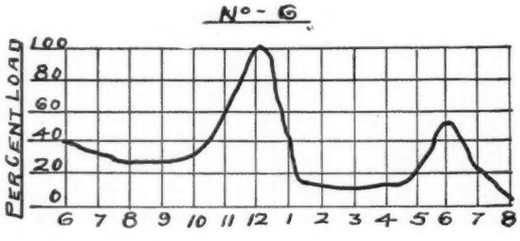
At the end of the second year the results showed that our revenue was $62,000 per year, and about the only increase in operating expenses was for coal. I was very glad to pay him according to our agreement and insisted on retaining him at a salary of $1,200 per year in an advisory capacity only.

Our two largest hotels looked as dark and gloomy as they could, and the owners would not install any more lamps. The solicitor, by making a special rate for a few months, lighted

one hotel, until it made the other look like a dungeon. That made the owner of the "dungeon" sit up and take notice. As soon as the dungeon was well lighted and a contract was secured, the solicitor had no trouble in securing a contract with the other.

We made a special rate of 3 cents per kilowatt hour, with a minimum of 5 cents per month per 2 candle-power lamp on signs, the customers agreeing not to light them before 5:30. As they came on after our 5 o'clock peak, our cost was only ½ cent per kilowatt. As the sign load would give us a revenue of nearly $60 per year per kilowatt, we considered it the best kind of business. Johnson showed me that if we charged 6 cents for sign lighting, we would, as a rule, not get over $60 per kilowatt per year, and as they would light them at 4:30 during the holidays, and be on our peak, there would be no profit to speak of, while at the 3-cent rate, with the 5:30 start, it was nearly all profit.

The gas company, seeing their "long burners" leaving them, and, in return getting our outcasts (short burners), began a very aggressive campaign and offered all sorts of cut-rate propositions. Johnson told me to call upon their manager and tell him that if he did not quit that kind of warfare we would give him a "dig" that would hurt. You can imagine what that manager said to me. After I reported the result of my talk with the gas manager to Johnson, he said that we would advertise complete electric cooking outfits for $80 on time payments, and would sell current for them at 2 cents per kilowatt hour. By advertising we had no trouble in assuring the public that it was cheaper, cooler, cleaner and more healthful than gas, and we put out 50 sets in two weeks. The gas manager came to me and asked me how much longer we were going to run that offer. I replied "forever," and he went away declaring that we would go into bankruptcy if we continued at such a price. Johnson contended that we were making a good profit on it at 2 cents, as you see the cooking load runs like No. 6. It is an all-day load until people begin



to get their supper. The load at 5 p. m. is not worth considering, and it gradually gets heavier until after 6. After we put in our new 500 kilowatt generator we cannot get enough residences to fill our load curve out from 5 to 6, so the cooking load will fill in there very nicely and only increase our expenses a little for coal. The gas manager intimated that if we would put the price up to 3 cents that he would quit cutting prices in the business district. But we were so strongly intrenched there that we thought we had better let the price remain at 2 cents, as it was a great "ad" for us.

You asked me how to organize and conduct a commercial department, and, after my experience, can safely say, hire the best commercial man in the country and let him do the rest. E. E.'s and M. E.'s are absolutely necessary in building and operating your plant, but don't expect them to be commercial men any more than you would expect your architect to manage your factory, office, bank or department store if he should build it. So far, the electric lighting industry has paid the high salaries to the engineers and have employed young, inexperienced solicitors at salaries from $40 to $100 per month to market the product from an investment of sometimes millions. For that reason "good salesmen" have never cared to go into the electric business, and consequently today, when there is millions of business to be sold, there are very few men capable of selling it. Let me show you the difference between a "good man" and a "cheap man." You wish to develop a certain very thriving factory district, where you have to make a long run to reach it, and you must secure a certain amount of business to warrant the extension. Your "good man" secures 75 per cent of the business that he goes after, your "cheap man" 30 per cent. Your "good man" therefore makes it possible to make the run and thereby gives a big revenue from that district, while you get none from the "cheap man's" effort. Every man that you go after and "land" is an advertisement, because he, to show his good judgment, tells everyone how nice and cheap electricity is. While the man that was solicited but not "landed" by the "cheap man" tells how he would not use it, as the price was too high.

I know of one case where a "cheap man" in talking to the manager of a foundry that was under construction let the manager calculate that one crane, one cupola blower, three rattlers, one emery wheel and one small air compressor, for chipping, would, at a 5-cent rate, cost him $8,000 per year. The manager proved to the "cheap man" that it would cost that much and the manager was about to order his steam plant, when a "good man" heard of it and called to see him. When he heard the manager's story, he merely said: "I know of a foundry where the conditions are identical, and, at a 5-cent rate, they only pay about $3,000 per year. You put in your motors, but let the central station handle you for a few months. Then, if your bills exceed that amount, and you still think you can save money by installing your own plant, do so." He got the business and kept it.

PRODUCTION AND USE OF MICA.

The report by Mr. G. O. Smith of the United States Geological Survey on mica in 1905 shows that production was limited to North Carolina, Colorado, New Hampshire, Georgia, South Dakota and New Mexico in the order named. The total output of sheet mica for these states was 851,000 pounds, with a total value of $185,900. Of this quantity North Carolina is credited with 669,000 pounds, valued at $85,000. The increase in production over the previous year was largely in other states, while the larger increase in value may be accounted for in part by high prices reported by producers in those states. A decrease in the average price for the North Carolina product is due to the increasing proportion of small mica produced for electrical uses. The total production of scrap mica in the United States in 1905 was 856 net tons, valued at $15,255, an increase in value over the production for 1904. North Carolina's output of scrap mica for 1905 was 175 tons, valued at $2,375. The separation of the production figures for scrap mica and for the smaller sizes of sheet mica becomes more difficult as the use of these small sizes increases.

The production of sheet mica in 1904 was 668,358 pounds, valued at $109,462, and of scrap mica 1906 net tons, valued at $10,854. Thus the value of the aggregated product of mica in 1905 was $201,155, as compared with $120,316 in 1904. The value of imported mica now used in the United States is twice that of the domestic article. In 1905 1,506,382 pounds of manufactured mica, valued at $352,475, and 88,188 pounds of cut or trimmed mica, valued at $51,281, were imported, making a total of 1,594,570 pounds, valued at $403,756.

The three principal uses of mica are for electrical insulation, glazing and decoration. The first-named application probably leads in present importance. The increasing use of mica in electrical manufacture has largely modified the demand made upon the mining industry. Small sizes of sheet mica are used in the manufacture of insulators for lamp sockets, lightning arresters, switch boxes and fuse blocks. More important even is the extensive use that is made of composite mica, micanite, molded mica and other varieties of built-up mica sheets.—"Electrical World."

ELECTRIC CURRENTS THROUGH GAS AND WATER PIPES.

The conclusions arrived at by a commission of the Verein von Gas und Wasserfuchmanner, after an investigation of the above subject extending over two years, are given in a recent number of the Elektrotechnische Zeitschrift. The commission addressed inquiries on the subject to the authorities of the gas and water works in 113 German towns, and it also carried out experiments on its own account in certain of these towns. In 15 of the towns electrolytic action had been noticed, and 48 specific cases were recorded. The first experiments for the commission were carried out at Elberfeld, and included the measurement of the potential difference (1) between the rails and the — pole of the dynamo, and (2) between the rails and a special earth connection near the supply station. Measurements of p. d. between rails and gas and water pipes were also made all over the district. Currents were measured at certain selected points in the pipes. The average p. d. between points on the rails was found to be 3½ to 4 volts, while currents of 3 amperes were found in the pipes. Where pipes crossed one another, a passage of current usually occurred. Current passed out of the pipes over an extended area, but appeared to be most dense near the station. It was found that the return cables did not equalize the potential of the rails at the various return feeder connection points. By inserting adjustable resistance in certain return cables an improvement in this respect was attained. A gas pipe lying close to the rails in the neighborhood of one of the stations was found to be greatly oxidized over its whole surface. The oxide penetrated the earth all around to a distance of 2 or more centimeters, and the iron surface itself was converted into a soft graphitic mass. A pipe lying below this one and crossing it was corroded at the crossing point.

In 1904-5 similar experiments were carried out in Strasburg, in Dresden, and in Hamburg. In Strasburg the following results were obtained: p. d. between rails and pipes in the vicinity of the station, 2.2 volts average (2.8 volts maximum), the pipes being positive; p. d. between rails and pipes far from the station, 4 volts average and 11.5 volts maximum, the pipes being negative. The voltage drop in return feeders had various values up to 6.5 volts. The positive feeders were of the same section as the return feeders everywhere. The longest return feeder carried only about one-third as much current as the corresponding positive feeder, while the shortest return feeder carried as much as four times the current of the corresponding positive feeder. The introduction of a resistance into this shortest return feeder reduced the p. d. between pipes and rails by about 50 per cent at all points of the system. The rail joints were often found to be defective—causing, for instance, in many cases a 100 per cent increase in resistance. Joints made by Dr. Goldschmidt's Thermit welding process, however, were very satisfactory.

In Dresden the power was supplied from two central stations, and around each station a region existed with voltage differences between rail and pipe of about three volts. Return feeders were in use, but these were of bare conductor laid in brick conduits, and were connected to the rails every 100 metres whenever they ran parallel to the rails. In this way they formed insignificant additions to the rail section, rather than actual return feeders.

In Hamburg, where a complete system of return feeders fitted with regulating resistances had recently been installed, the maximum voltage difference between rail and pipes was 1.5 volts (rail positive), and an average voltage difference of ½ volt existed in places where the pipe was positive. Before the re-arrangement of feeders, the maximum p. d. (pipe positive, in the neighborhood of the station) was about 5 volts.

Besides the above electrical measurements, some chemical and electro-chemical experiments were also carried out with a view to deciding how far other circumstances than the earth return currents were responsible for the decomposition noticed. The chief work of the commission, however, was confined to the return feeder system, and to the existing voltage differences, and little was done in connection with the earth currents themselves.—"Electrical Review."

A franchise has been granted H. P. Clark, as trustee of a proposed company to be formed in Salt Lake City, to construct and operate an electric interurban railroad through that city. Construction work is to begin immediately, and it is expected that it will be completed within 18 months. By the terms of the franchise the city is to receive 1½ per cent of the gross earnings during the first five years of that portion of the road within the city limits and 2 per cent per annum after five years, with $1,000 fixed as the minimum amount which the city will receive annually. The chief promoter of the enterprise is W. G. Purcell of Los Angeles.

Ernest L. Godbe of Salt Lake City has filed two applications with the state engineer, each for the appropriation of 54 second feet of the water of Coyote creek, in Garfield County, Utah, for the purpose of generating electric power to be used in the Coyote Mining District. The proposed plants are each to operate under 75 feet of head.

A NEW APPLICATION OF ELECTRIC MOTORS.

New industries are constantly joining the ranks of those operated by electricity. The adaptability, economy and general efficiency of this form of machine driving have led to its installation not only in the more ordinary manufactories, but in the less known fields of various classes of work. One of the most recent establishments to adopt this method of drive is the Archer-Daniels Linseed Co. of Minneapolis, Minn. The process of making linseed oil and cake from the raw material is very interesting, and the induction motor has been found to adapt itself perfectly to the cycle of operations.

The first step in the process in which the motor has been adopted is at the storage bins. The raw material, flaxseed, is elevated by a 30 horsepower induction motor to the cleaning room. Here the seed is freed from dust and dirt by motor-driven fans, the refuse being sucked up and carried to the waste bins by exhaust fans driven by the same means. The flaxseed then goes to the grinding mill, the elevator and conveyors being motor driven. The grinder is operated by a 60 horsepower 2,300-volt induction motor, and the seed is reduced to meal of about the fineness of graham flour. The flour is then cooked about an hour and a half in steam jacketed kettles, and the oil is expressed by hydraulic presses, the pumps for which are driven by induction motors. From the presses the oil is pumped first to large vats, then filtered to tanks on a lower level, and again pumped to storage tanks. All these various pumps are driven by induction motors.

The switching and wiring arrangements in this establishment are very complete. All the motors of 35 horsepower and over are operated directly at 2,300 volts, the connections being made through three-phase lead-covered cables in iron conduits. Each motor has a controlling panel, and these are grouped on the different floors so that all the motors in one department can be controlled from one point. The central controlling panel is located in the basement, which receives the power from the 2,300-volt service and distributes it through non-automatic oil switches and expulsion fuses to the various motors in the building. In an annex outside the main building a 56-kilowatt three-plase transformer is installed for supplying current to the 220-volt induction motors of small power. In this same transformer house there is also a 20-kilowatt single-pole transformer arranged for lighting the building. The current for the transformers is first brought to the main switchboard and then distributed to them through oil switches. From the transformers the wires run directly to the small motor and lighting panels. The complete electrical equipment of this unique plant was furnished by the General Electric Co.

ELECTROLYTIC CORROSION OF STRUCTURAL STEEL.

At the last annual meeting of the American Electrochemical Society, held at Cornell University in May, Dr. Maximilian Toch of New York City presented a paper containing an account of recent researches made by him of the electrolytic corrosion of steel in building frames. Engineers have commented publicly on the electrolytic corrosion of structural steel, particularly those parts known as "grillage beams," supporting columns and base posts, which are either in the ground or surrounded by concrete and partly above the ground, with a view to determine beyond question at which of the poles corrosion occurs, and whether one pole is more active than the other.

The first experiment was performed by taking two sheets of high-grade watch-spring steel, which is extremely susceptible to corrosion, and connecting them with the ordinary bluestone telegraphic cell. A Pignolet combined volt and ammeter was placed in the circuit, and the two pieces of steel buried up to 5 inches in sand. The voltage was 0.05, the current varied from 0.02 to 0.05 amperes, and the distance between the plates in the damp sand was 1½ inches. Careful observation was made every day to see that the current was uniform, and the sand was first moistened with salt water and then continually moistened with distilled water, so that the same strength of salt solution was maintained. This experiment was conducted for 100 days, and assuming that the current travels from plus to minus, or from anode to cathode, the anode being connected with the copper and the cathode being connected with the zinc, corrosion was noticed almost immediately at the anode, and the plates showed violent corrosion at the anode and practically no corrosion at the cathode. The plates indicated some slight corrosion on the cathode, which, however, was principally chemical corrosion.

The next experiment was tried exactly in the same manner—for a shorter period of time, but instead of using two plates three plates were used, the third one being designated as the "free" plate, in which chemical corrosion had full sway. It was not connected by any wire to the electric circuit. At the end of six days these plates were removed; the anode showed marked corrosion, the cathode plate showing practically no corrosion at all, and the "free" plate showed a fair average between the cathode and the anode, and it can be deduced that the difference between the cathode and the anode corrosion is equal to the "free" corrosion. In other words, there is many times more corrosion on the anode than there is on the "free" plate, and no corrosion on the cathode plate.

The plates were very carefully varnished all over to preserve them after the experiments were completed. The rust producd was first the green ferrous oxide, Fe (OH) , which, being a very unstable product, was quickly converted in the air into Fe O (H O).

The voltage was 0.1, and the current 0.1, of an ampere. The salt solution was four times as strong as that produced in the first experiment.

The third experiment was, however, of the greatest importance, owing to the fact that the author attempted to imitate the conditions exactly as they existed in buildings. The same kind of steel was taken and bedded in various mixtures of concrete, starting from neat cement and going up to 1, 3, 5.

There is a well-known law in physical chemistry that reactions which take place with an increase of pressure are retarded by an increase of pressure, and the question has come up as to whether it is possible for steel to corrode when surrounded by concrete, many engineers holding that the alkaline nature of the cement will prevent the corrosion, and others holding that in conjunction with this condition the pressure exerted by the concrete prevents chemical decomposition. Dr. Toch, in order to throw some light on this subject, made the following experiment:

In the first place, cement was taken of known composition, agreeing practically with the definition as quoted in the Journal of American Chemical Society, 1903, Vol. XXV., No. 7, July, when the question of the permanent protection of iron and steel by means of cement was thoroughly gone into. The cement for these experiments was what might be termed a tricalcic silicate and calcium aluminate. This is in contradistinction in the general classes of Portland cements containing dicalcium ferrite as a part of their composition and free calcium sulphate in excess. A cement of the calcium aluminate class, free from iron and free from calcium sulphate, is a well-known protector of steel and iron against corrosion, and this class of cement was used in these experiments. The pieces of steel were connected up with six elementary cells of sufficient high voltage and amperage, and it was impossible to get a direct reading on the volt-ammeter, the instrument being too sensitive. The seven pats of cement containing the steel strips were then put into the circuit and wet every few hours with solutions of 5 per cent sodium chloride and 1 per cent nitric acid and water, in order to increase their conductivity and produce corrosion as rapidly as possible.

The average voltage was 0.05 and the current 0.05 amperes throughout the entire experiment. Corrosion was immediately noticed on the anode pole, and the pat made of neat cement, which should have protected the steel most perfectly against all kinds of corrosion, showed a hair line split colored with rust at the end of the third day, which demonstrated that the chemical reaction of rusting had taken place at the anode; that the molecular increase had likewise taken place, and the pressure caused by the molecular increase had split the block.

The steel in each alternate pat was painted half the length, which was embedded in the cement with an insulating paint of known composition. The results obtained after these various briquettes were broken open, demonstrated that electrolytic corrosion takes place most violently at the anode unless the steel be coated with an insulating medium. Cement, concrete, or even neat cement, is, therefore, no protection against electrolytic corrosion unless the steel be insulated as heretofore mentioned. There was absolutely no corrosion where coated with insulating material. It must be noted that the cathode in all these experiments was perfectly free from any signs of oxidation.

The result of this entire series of experiments is to prove conclusively that electrolytic corrosion of structural steel embedded in concrete or sand takes place only at the anode, and there with great violence; and, furthermore, that the cathode is protected by the electrical current. The popular impression that cement is a protector against corrosion of all kinds is fallacious, and that the anode does not only rust very violently, but a molecular increase of volume may take place which will split the concrete shell.

Another conclusion arrived at is that the electrolytic rusting of grillage beams of buildings need not be feared if the structural steel be protected by a good insulating material, but the insulating medium should form a bond with concrete.

Dr. Toch's paper produced quite an animated discussion, in which Messrs. Acker, Bancroft, Hering, Palmer, Richards and Rodman participated. Mr. Rodman said that if steel is protected as cathode, then the steel structure of buildings should be artificially made a cathode. Mr. Hering referred to a means for this purpose, which consists in burying zinc in contact with the steel in the ground. This represents a short-circuited cell, in which the steel is the cathode; of course, the zinc is gradually consumed, but the steel is protected. The method is exactly the same as for the protection of boilers. Prof. Bancroft asked whether there was not with this method a possibility of a leakage of current from one steel cathode to another steel cathode, whereby the former one would, of course, be corroded. Mr. Acker spoke of a case in which he had been interested, of the destruction of gas and water pipes by the stray currents from an electric tramway system. The

trouble was successfully overcome by improving the bonds between the rails and installing special return feeders, for the purpose of preventing stray currents from passing into the earth. Mr. Hering referred to the method which is usually employed in reports on the effects of stray currents from railways, and which consists in measuring the potential difference between rails and pipes; but it is not the potential difference but the ampere-hours which determine the amount of corrosion, and it is not proper to assume a large current with a large potential difference, since the conductivity of the ground is hereby entirely neglected. It is, therefore, not sufficient to measure the potential difference alone.

THE VERTICAL RETORT FROM A PRACTICAL POINT OF VIEW.

(A paper read by Mr. Ernest Koerting of Berlin at the last meeting of the Institution of Gas Engineers, London, England.)

At the present moment there are three systems only of vertical retorts more or less beyond the experimental stage —the Dessau, the Woodall-Duckham and the Settle-Padfield. The three are enumerated according to their degree of similarity to the ordinary practice, beginning with the slightest and finishing with the greatest deviation from the same. The characteristic feature of the existing methods being the thin layer of coal and the free space above the same throughout the whole length of the retort, it is interesting to note that the inventors have in each case given up one of the essential conditions.

Dr. Dueb and Messrs. Woodall and Duckham do entirely away with the free space, and keep the retort always full of coal, with the object in view of removing all the volatile matter as quickly as possible. Messrs. Settle and Padfield, on the contrary, leave the greater part of the retort without coal, thus creating a heating chamber, in which the bulk of the tar vapors is to be gasified. But there are also important differences between No. 1 and No. 2. The Dessau retort is charged and discharged at intervals, as has been customary since the beginning of the gas industry. The production of gas is comparatively large in the beginning and small toward the end of the carbonization, as in horizontals, but not in the same degree, and corresponds with an initial bottom pressure of several inches against a final one of only some tenths. It is, in consequence, practically impossible to work these retorts with a vacuum, or to work them at all unless they are tight. This circumstance sets a limit to the application of steam, which must not be carried beyond the point of leaving a thin coat of carbon inside the whole length of the retort. The continuous working of the Woodall-Duckham retort, on the other hand, insures a uniform pressure and permits the use of a vacuum, which will counterbalance the effect of any leaks. In consequence, a very large amount of water gas may be produced in this retort, the bottom part of which is always free from carbon. The three systems might, therefore, be classified in the following manner:

1. Dessau—Intermittent carbonization in completely full retorts with a limited and arbitrary admission of steam.

2. Woodall-Duckham—Continuous carbonization in a completely full retort combined with an ample, but to a certain degree obligatory, admission of steam.

3. Settle-Padfield—Continuous carbonization in a partly empty retort, combined with gasification of the tar vapors.

Obviously there are here a great variety of aims and methods; and to do them all justice from a practical point of view would require a very intimate knowledge of each different plant and the working results thereof, which the author does not unfortunately possess. He is, therefore, obliged to base his remarks mostly on his own experience with the Dessau retort, with a side glance naturally at the other systems, whenever an opportunity occurs.

When criticizing a new system of furnace, the practical engineer will ask first and foremost: "What will be the cost of erection per unit of gas produced?" And the answer must be, that there is not, as far as it is possible to see how, much chance of building a Dessau vertical furnace at a lower price per unit of gas produced than an inclined one. Retorts, generators and recuperation are necessary as in any other oven, and if the props between the retorts are much simplified the supports and the handling gear of the bottom mouthpieces will counterbalance this advantage. But the retort house will certainly be cheaper in erection. A house of the ordinary type with two rows of furnaces and the hot coke conveyors—not below, but alongside the retorts—will require 10 per cent less in length and 20 per cent less in breadth than a house for inclined ones of the same output. There are also structural improvements under consideration, which promise some additional gain.

It is probable that the Woodall-Duckham furnace, with its large output per retort, will be in a still more favorable position with regard to the retort house. The principal advantage, however, of the vertical retort must be looked for in the working results. The gas industry is nowadays in the somewhat precarious position that the demand for, and the cost of, the principal raw material is steadily increasing, whereas the price of gas and all by-products—with the exception perhaps of ammonia—has a downward tendency. There are fluctuations and interruptions as well as local exceptions in this development; but on the whole the writer fears it must be regarded as a fact. The following table shows the Berlin coal and coke prices for the last 10 years:

1896	13s. 2d.	19s.10d.
1897	13s. 8d.	19s. 8d.
1898	14s. 2d.	16s. 8d.
1899	15s.11d.	15s. 8d.
1900	25s. 3d.	25s. 3d.
1901	16s. 6d.	24s. 9d.
1902	17s. 1d.	18s. 3d.
1903	16s. 2d.	16s. 2d.
1904	15s. 8d.	16s. 0d.
1905	16s. 3d.	16s. 8d.
1906	17s. 6d.	.....

For instance, in 1896, 13s. 2d. was paid for a ton of English coal, and 19s. 10d. was realized for a ton of coke against 16s. 3d. and 16s. 8d., respectively, in 1905. The great problem, therefore, is to find means of materially increasing the production of gas per ton of coal without too much impairing the quality; the standard tacitly accepted in North Germany being a gross heating value of 5,000 calories, or 560 B. T. U.; and it is most gratifying to learn that all three systems of vertical retorts make the claim of producing more thermal units in gaseous form out of a given quantity of coal than was possible hitherto. In highly-heated horizontal retorts, the present make at Berlin per ton of coal is (say) 11,000 cubic feet of 5,050 calories, or 567 B. T. U.; but this can only be done by mixing some Silesian with the Durham coal, in order to avoid thick tar.

The vertical furnace can carbonize English coal alone without the slightest inconvenience. A recent fortnightly trial with good Durham coal (Boldon) gave the following results:

1. Coal Gas Alone, Without the Admission of Steam—Gas produced per retort and day, 15,200 cubic feet; gas produced per ton of coal, 11,700 cubic feet; heating value, 614 B. T. U.; illuminating power, 13.5 candles, being the same, or slightly higher than that of gas made in horizontal retorts.

2. When steam was admitted, the make per retort increased to 17,250 cubic feet, and the production per ton to 13,250 cubic feet; whereas the heating power still kept at the comparatively high figure of 579 B. T. U., and the illuminating power was reduced to 11 candles. When steam is not admitted to the retorts, water gas may be sent into the hydraulic, as has been also tried in Mariendorf. It may be said

that in Dessau vertical retorts, and with the help of steam and water gas, one ton of good Durham coal will yield 13,500 cubic feet of gas, with an average heating value of 560 B. T. U. It is not many years since 10,000 cubic feet per ton of coal was considered a fair production. It cannot be denied, therefore, that substantial progress has been made.

The fuel account will not be abnormal either. It is true the trial furnace requires 16 per cent. on coal carbonized by weight; but as it is standing quite alone, and unprotected from all sides, a considerable reduction is certain as soon as a number of ovens are combined in one block. Other advantages of the gas produced in verticals are the almost entire absence of naphthaline, and a gain in ammonia of 40 to 50 per cent. The coke is of excellent quality—large, dense and hard; and the tar is a light brownish oil, ever so much richer in hydrocarbons than is the ordinary tar, and therefore, in times of a depressed market, it is of a much higher value either as fuel or as gas producing material. These are improvements in the quantity or quality of gas and all its by-products. They mean nothing less than a step in advance on the whole front of carbonization, and will no doubt result in a more or less considerable monetary gain in each case.

In addition to the high coal prices, labor is the great consideration to the modern gas engineer, and its reduction to the minimum the general desire. In aiming at this object, the vertical retort will be found a good and valuable ally. Messrs. Woodall and Duckham go so far as to promise the entire abolition of retort house labor. According to them the retort house of the future will only require some slight supervision. There is also very little labor in the case of the Dessau furnace—two men only being necessary for the charging and discharging work. The top man has to fill the measuring vessels from the continuous overhead coal hoppers and to let their contents drop into the retorts. His task is by no means so heavy as that of his colleague on the top side of the slopers, for there is no pushing down of coke and no fiery oven in front of him. The other man below has to handle some levers for opening and closing the bottom lids. As the coke will automatically slide over the movable shoot into the hot coke conveyor, there is not much labor in this either, even if the man should be obliged to tickle the coke with a rod in the rare case of a charge not moving out at once.

One of the most objectionable operations in the retort house is, as every gas engineer knows, the auguring. Every Berlin stoker has to give one hour and a half out of twelve to this hot and disagreeable task, for all the ascension pipes must be gone through five times a day. Their fortunate colleagues of the verticals will have no experience of this nuisance. It is quite sufficient if they introduce the augur just once in twenty-four hours. It will go through without resistance; such a thing as thick tar not being known in the gas pipes and hydraulics of a properly filled and heated vertical retort. There is no scurfing of retorts required either, as the small quantities of carbon deposited on the walls are continuously transformed into water gas.

But all the hot labors associated with the daily programme of the stoker of inclined retorts have not yet been mentioned. He must once a day clean and lubricate all the levers of the top mouthpieces, and push eight or nine red-hot retort charges per day into the generator of each furnace. The top and bottom mouthpieces of the verticals are so cool that they do not require special care, and the generators are large enough for a 36 hours' coke supply. They will be charged (say) once in 24 hours from an overhead hopper, and in the easiest way. It will be seen, therefore, that the stokers will have their work considerably reduced.

But the principal advantage is the long hours of distillation. With Durham coal and a maximum admission of steam, 12-hour charges will probably be found most convenient, and prove to be very suitable for the 8-hour day. One might, for instance, make a charge every four hours—say, at 9 o'clock, 1 o'clock and 5 o'clock in the day time, as well as at 9, 1 and 5 o'clock in the night and morning. The three day-charges would be made by one 8-hour shift, and the three night-charges by another 8-hour shift, no man and no work being necessary in the four hours' interval left each time between the two. In other words, the long hours of distillation would make it possible to work 8 hours with only two shifts in 24 hours; and these shifts might commence and finish their work at hours fitting excellently into the ordinary routine of family life. It is obvious that all these advantages must cause a considerable reduction in the cost of labor as well. But as the inclined and the mechanical stokers have done already so much in this respect, the gain cannot be so important as it was with them. Nowadays so much is heard about the grievance of the working man that the other less numerous, but far more patient, beast of burden, the engineers, do not appear to come into consideration at all. Nevertheless it may be mentioned that the vertical retort has for him also some relief and some benefits in store. Simplicity of construction and supervision cannot be regarded as merits of the Coze oven. It is, however, very easy to regulate the heating of a Dessau furnace; and the Woodall-Duckham system does not require any regulating at all—the combustion on the top securing uniform heats as a matter of course.

Very often gas works are blessed with fault-finding neighbors, and then the retort house is a continuous reason for complaints. Here, again, the engineer may welcome the vertical retort as a helpful friend. Messrs. Woodall and Duckham promise him a retort house similar to a workshop, and perfectly free from dust and vapor; and the Bueb furnace, after having done away with the scurfing, does not send forth any more black clouds of smoke from the chimneys, and reduces the nuisance of charging and discharging by 50 per cent, owing to its long hours of distillation. There is also every reason to believe that the engineer will be pleased with the durability of the vertical system. A vertical retort, quite free from outside pressure, always brimful, and never, or very rarely, submitted to the sore trial of scurfing, fulfills, one would imagine, all the conditions necessary for a lengthy life—so long, of course, as it is not exposed to dangerous temperatures. The top half of the Dessau retort is so cool that it must remain in good working order for a very long time indeed. This will be the case in a still higher degree with the bottom half of the Woodall-Duckham retort; for it is kept comparatively cool from the outside, and has always the same temperature on the inside, being, into the bargain, never emptied as long as the furnace is in action.

The foregoing statement is so far merely an enumeration of advantages. The author is therefore prepared for the question: Where do the drawbacks and limits of the vertical retorts occur? A question, however, which he is only able to answer with regard to the Dessau system. It is certainly a disadvantage that some coals expand during carbonization, and do not quite automatically slide out of the retort. Germany, for instance, is in possession of three important coal fields—the Ruhr or Westphalian, the Saar, and the Silesian. All the Ruhr and Saar coals tested till now are excellently adapted for the vertical retort; but several of the best marks of Silesia coals are decidedly not so. Among the numerous other coals—viz., French, Belgian, Durham, Yorkshire, etc.—that have been tried, none have been found to be unsuitable, although the so-called creeping coals are not quite so satisfactory. Similar differences, however, may be observed in all sorts of retorts. The Silesian coke, for instance, being small, hard and brittle, causes much friction, and is by no means easily discharged from slopers or horizontal through retorts, which moreover are liable to lose their shape and part of their efficiency at a comparatively early age. Fortunately, it seems that properly heated vertical retorts keep in good form to an astonishing degree. The Mariendorf retorts, after 300 working days, are in excellent condition.

"Rebus sic stantibus," one may say that the vertical retort is at present in the following position from a practical point

of view: It is already certain that there are a number of advantages, and also one or two drawbacks, connected with the new method of carbonizing in vertical retorts; and no doubt more than one gas engineer would be willing to adopt it. But there is such an "embarrass de richesses" in designs and possibilities that he cannot make up his mind which to adopt. Three different systems are already more or less past the experimental stage; others are announced as being tried; and, in addition, there are well known gas engineers publishing their theories on verticals and giving detailed designs as to how they ought to be developed. It is, of course, at all times a rare intellectual pleasure to watch a well trained brain occupied with an invention, but a certain danger will be always connected with technical or chemical speculation. Nobody can foretell how the finest theory will stand the fire of practical trial. One missing link, one slight discrepancy, may wreck the whole train of deduction, especially on such an obscure subject as carbonization.

The great technical periodicals in Germany therefore follow the rule that the plants must be built and processes tried before the designs and descriptions of them are accepted for publication; for the average engineer and reader looks at things from a practical point of view, and wants experience, facts and figures. The initiation of the Bueb retort was quite in accordance with these ideas. After a full trial of the furnace in Dessau, a complete account was published, the results of which were afterward controlled and confirmed at Mariendorf. It was then known that by the simple means of putting the retort upright, without any complication by machinery, etc., noteworthy results were obtainable. This knowledge was sufficient to induce quite a number of Continental gas works to adopt the new system, which before long will be tried in many different places. But it seems to be the general idea in England that, by a more elaborate application of heats, and by a continuous process, much better results can be obtained. From a practical point of view, it is, of course, of the utmost importance to know as soon and as fully as possible whether this is really the case. The results of the Woodall-Duckham furnace especially will throw much light on the interesting points, and the publication of them is highly desirable; the following questions being essential:

1. What is the amount of fuel per ton of coal carbonized?

2. What is the quantity per ton, and per retort, and the heating value of the gas produced?

3. No. 2 being of great importance, by what means has it been secured that always good average samples of the gas are taken for analyzing purposes? (It may be mentioned here that in the Dessau gas works for a long time trial furnaces were the only ones in action, and that in Mariendorf a small holder is provided for testing purposes, which is filled each time within 24 hours, taking absolutely equal quantities of gas per unit of time.)

4. By what means is the taking of good coal samples secured for analyzing purposes, for as it is not probable that the eventual gain in heating power is in excess of the differences constantly found in the quality of our coals, it is absolutely necessary to control the results of the trial furnace by daily coal analyses.

Whatever the results may be, one conclusion seems definitely established, viz., that the vertical retort is of great practical importance, and that engineers of all nations will be thankful to anyone who undertakes the irksome task of making trials in a new direction, and of publishing his results. Cordial acknowledgment is also due to all those corporations and boards of directors who have regarded it as a "nobile officium" to grant means for researches. There will be no victors and vanquished either in his peaceful international contest. For all the results are of value to the practical engineer—the successes as well as the candidly avowed failures. Let us hope that the combined effort of so many engineers and so many nations will bring a good harvest of success to the old industry, born and brought up like so many of her sisters, on the fertile ground of this country.

ELECTRICALLY DRIVEN AIR COMPRESSORS.

In a recent paper presented to the British Institution of Mining Engineers there is given a description of the application of electric power to the driving of air compressors at the Ouston colliery. The author expresses his confidence that as the use of electricity, and more especially the distribution of that power from central generating stations, becomes more general, so also will the use of underground electrically driven air compressors of a suitable portable design, to be moved forward as the face advances, be adopted. In this particular case electricity at the coal face was out of the question, owing to the amount of gas given off by the Busty coal seam. Moreover, there was already a well-equipped electric central generating station at the pit, which not only supplied current for the pit in question, where underground pumping and haulage were already extensively done by electricity, but also for distribution to surrounding pits for coal cutting, haulage, etc. Although compressed air was not an absolute necessity at the face, it allowed heading machines to be used in a seam, the opening out of which by hand labor was not only a heavy proportion of the total cost, but a very slow process. At present two air compressors are at work, one of which is an English and the other an Ingersoll-Sergeant machine. The intake air is filtered by passing it through a box containing four perforated iron plates, with layers of cotton wool between, fixed at the outer end of the wooden boxing. Both machines are provided with automatic unloading devices to keep the pressure in the air receiver uniform within a range of two or three pounds. The compressors are driven by duplicate compound wound 90 horsepower motors, running at 500 volts and 550 revolutions per minute. There are seven Ingersoll-Sergeant heading machines at work, the cylinder, 5 inches in diameter and 17-inch stroke, making 180 strokes per minute at a working pressure of 60 pounds per square inch. The machines have given very good satisfaction. The second part of the paper describes in detail the former and the present method of opening the Busty coal seam, and the author gives a series of tables showing the working costs.

Californians visiting New York in the future will certainly feel not far from home if they make it a point to go often to the quarters of the Eastern bureau of the California Promotion Committee. These are located in the Metropolitan Life Insurance Building on Madison Square and just across from the famous Flatiron Building. California magazines and newspapers are kept on file, and those in charge promise to dispense all kinds of information about New York and elsewhere in the true Californian spirit.

Rufus P. Jennings, chairman of the committee, is on an extended trip throughout the East at the present time, giving wider publicity to the work of the organization. He reports a visit with President Roosevelt, in which interests of great importance were discussed, and afterward took luncheon with Commissioner Franklin K. Lane.

A NEW USE FOR GAS.

A shortage of wood in Litchfield county, Connecticut, has led to a new application of gas as an industrial aid. According to the "Birmingham Post," the lack of the usual fuel was threatening the restriction and possibly the entire abandonment of a once flourishing lime-burning business, when it was suggested that experiments should be made with gas as a substitute. As a result, the daily output of the kilns at Canaan and New Milford has been increased from 80 barrels to 100 barrels a kiln. It is alleged that this is the first instance in any country of the use of gas in lime-burning.

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EDITORIAL.

Water Power and Steam Driven Electric Power Plants.

Maximum economy results when special conditions are met by the method best adapted to the particular case under consideration. Sometimes steam is most economical for generating electric power, and transmitted energy from water power in other cases costs less. Many times, however, a combination of the two gives the most economical results. One of the great advantages of alternating current electric power transmission is the ease with which a great number of stations may be operated in synchronism when connected in the same system. A system may include from two to twenty different generating stations, located as much as two hundred miles apart. The load factor or variation of the power demand during each day will determine in most cases the advisability of operating either water or steam driven stations, if one only is to be used.

An excellent illustration of the many advantages of operating steam and water power plants together as parts of a large transmission and distribution is shown by the Pacific Gas & Electric Co., consisting of what were formerly known as the California Gas & Electric Corporation and the San Francisco Gas and Electric Co. On account of small transportation costs, fuel oil, which is now the generally accepted fuel for California, is cheapest at or near tide water. On the other hand, in the gold mining and gold dredging districts or the "foothills" of the Sierras, fuel oil, due to higher transportation costs, is more expensive.

Electrical energy from water power is naturally cheapest when the place of consumption is in or near the mining districts, where the elevation is from fifteen hundred to two thousand feet. The cost of water power generated and transmitted energy near tide water on the other hand is much greater than at the point of generation, due to the investment and maintenance charges for the transmission lines.

The combination of fuel oil plants, either steam or gas, at or near tide water, connected by transmission lines to one or more water power plants in the Sierras, will necessarily give the most economical operating conditions. Under some circumstances, during the season of low water, for instance, the steam or gas driven electric plants will be called upon to furnish a large fraction of the demand. On the other hand, during the hours of minimum demand and at seasons of flood water, the steam of gas driven stations may be shut down and held in reserve only to be run when required. Such a system must naturally be a large one in order to adapt itself to the changes of load which result where power and light are used for many different purposes.

When a number of generating plants are "tied in" to one large system it is always necessary to operate the alternating current generators in synchronism. This is not difficult, providing proper care is given to the design of the engines or turbines which, through direct connection, drive the alternators in the steam or gas operated stations. The synchronous operation of all such plants not only minimizes the danger of shut down, but tends to improve the regulation of the entire system.

On the Pacific Coast with its extensive electric transmission systems, water power and steam driven units are rarely found in the same station. This is, of course, due to the high cost of fuel oil if transported into the districts where water power is available. In the East, however, such installations are not uncommon, as is set forth in the description, in another column, of the Holyoke Electric Company's plant at Holyoke, Mass. It is immaterial in such plants whether the water power be considered the auxiliary to the steam plant or vice versa. Steam engines, gas engines or steam turbines seem equally well adapted to driving generators to be operated in synchronism with water wheel units, providing the frequency is as low as 25 to 30 cycles per second. For electric systems when the frequency is 60 cycles, both the steam engines and steam turbines have given most satisfactory results, but as yet the gas engine has not been extensively introduced, and for this reason has not been fully tried out.

ANNUAL REPORT OF THE ALAMEDA MUNICIPAL ELECTRIC LIGHT PLANT.

The annual report of the electric light and power system, operated by the city of Alameda, for the twelve months ending June 30, 1906, has been made public, and contains much information of value to those interested in the municipal ownership of electric light and power plants. The report is one of the most complete that has been issued by the city of Alameda upon its electrical system. In general, the figures presented in the report are summarized below:

The plant consists of a frame power station building containing the boilers, engines and generators. There are four return flue fire tube boilers, each 72 inches in diameter by 16 feet in length, the boiler plant being equipped with a complete oil burning system. Water is supplied from wells, one of which is on the ground and the other in the City Park 1,200 feet distant, where is located a deep well pump connected to the electric motor. Steam engine No. 1 is a horizontal cross compound Buckeye with cylinders 17½ inches and 32½x32-inch stroke. This engine drives by belt a Stanley 240 kilowatt 2-phase 2,400 volt generator.

The second and smaller unit consists of an Ohmen tandem compound engine with cylinders 12 inches and 24x13 inches belted to a Stanley 150 kilowatt 2-phase generator.

The third unit, which has been in operation about a year, consists of a Harrisburgh tandem compound horizontal engine with cylinders 19 inches and 32x20 inches, directly connected to the National Electric Co. revolving field, 2-phase 2,400 volt generator. There is now being installed a second unit which will consist of a Harrisburgh engine with cylinders 17½ inches and 34x22 inches, directly connected to the National 2-phase alternator, a duplicate of the generator now in operation.

The city owns and has in use on the streets 1,424 poles, or a total of 174 miles of wire. The city lighting during the twelve months ending June 30 consisted of 142 enclosed alternating current Westinghouse arc lamps, 383 25 candle-power incandescent lamps and 99 16 candle-power incandescent lamps.

For the year, the output of the plant for street lighting was 202,405 kilowatt hours, and for commercial lighting and power was 941,680 kilowatt hours, or a total of 1,144,085 kilowatt hours. For commercial lighting there were 1,039 private meter and 92 flat rate consumers connected to the system.

Expenditures for the year aggregated $52,687.21, of which $36,455.11 was for operating expenses and $16,232.10 for new construction. The earnings of the plant as given by the report are:

For city municipal street lighting	$20,594.45
Commercial, residence and business lighting	29,504.30
Commercial power	2,417.20
Miscellaneous income	2,230.05
Total	$55,746.00

Including only the expense for operation, this would indicate the net earnings for the year to be $18,290.89.

The relation between the increase in the income for the year ending June 30, 1906, and the year ending June 30, 1905, and the cost of operation for these two years is set forth in the following figures:

Cost of operation year ending June 30, 1906	$28,602.35
Cost of operation year ending June 30, 1905	27,298.25
Increase	1,304.10
Earnings private consumers year June 30, 1906	34,151.55
Earnings private consumers year June 30, 1905	22,801.10
Increase	$10,350.45

Increase in per cent for operation, 5.78.

Increase in per cent of earnings, 43.5.

The price of fuel oil per barrel delivered in tanks at the plant is given as follows:

July 1, 1903, to October 1, 1903	$0.70
October 1, 1903, to October 1, 1904	.85
October 1, 1904, to October 1, 1905	.65
October 1, 1905, to July 1, 1906	.55

The street lights from July 1, 1905, to November 1. 1005, were operated on a moonlight schedule until 2:30 a. m. From November 1, 1905, to June 30, 1906, they were operated on a moonlight schedule all night. For the year ending June 30, 1906, the street lights were operated for a total of 2,113 arc lamp hours.

The investment in the plant June 30, 1906, is given as $91,076.82. The total investment was $107,317.08, from which is deducted depreciation changes, etc., of $16,240.26, this depreciation covering two full years ending June 30, 1906.

Previous to August 1, 1906, the electric plant was operated non-condensing, and a system of direct current open arc lamps was used for street lighting. Since May 1, 1904, the plant has been operated condensing, and the present system of alternating current enclosed arc lamps has been in use. These two changes have resulted in a saving of about 120 barrels of oil per month in the operation of the system, with the same output of plant.

BOOK REVIEW.

The Management of Electrical Machinery. By Francis B. Crocker, E. F., Ph. D., and Schuyler S. Wheeler, D. Sc. 218 pp., 131 illustrations. The D. Van Nostrand Co., Pub., New York. Price $1.00 net.

The first edition of this volume appeared in 1892 and since then two revisions have been found necessary in order to keep the book up with current electrical engineering practice. In the edition just issued, the authors have adhered to their original purpose, which is to furnish concise information on that phase of electrical engineering with which the dynamo tender, the power station man and the electrician are primarily concerned; namely, the installation and management of electrical machinery.

In Part I are discussed the points to be considered in selecting and installing machines, the various ways for belting and connecting them, besides the types of fuses, switches and circuit breakers in general use. The wire connections, the starting and the operation of generators, either singly or in parallel or series, and of direct current, syncronous or induction motors are given in a way which can be readily grasped by the non-technical man.

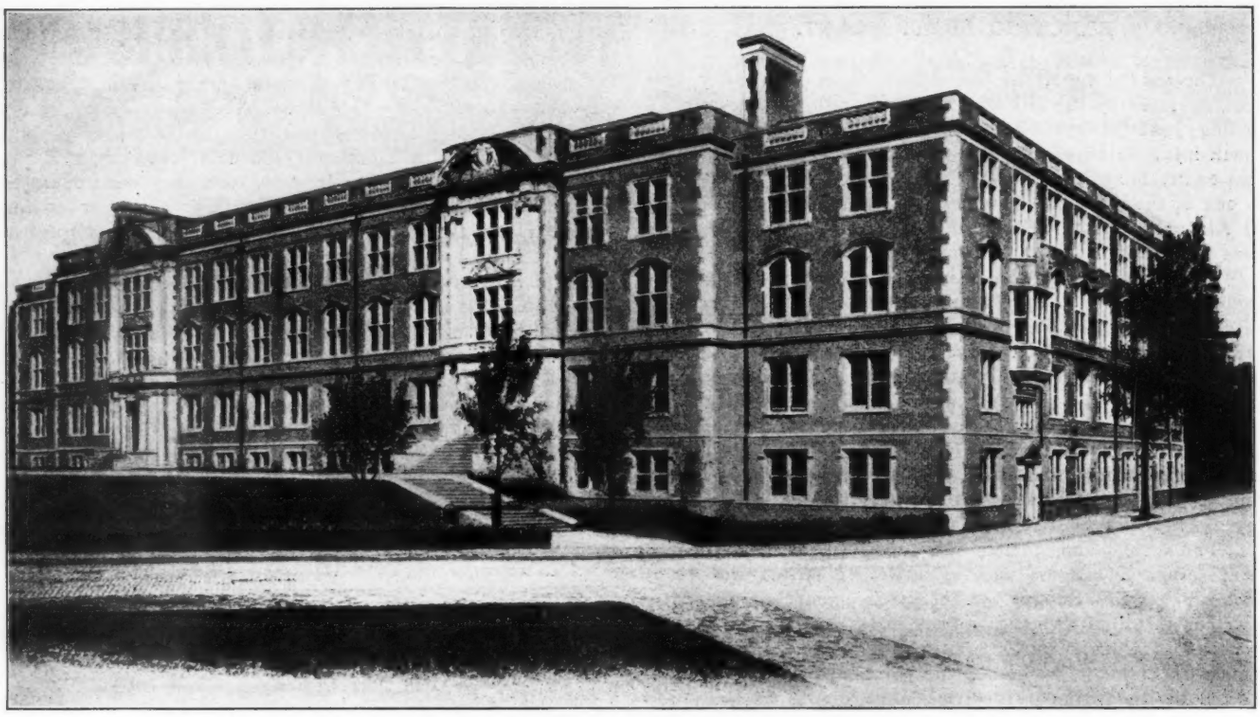
Part II deales with the inspection of installed machinery, and gives the most common ways for determining insulation resistance, voltage, current, speed and torque. Part III is a most important one for the electrician, inasmuch as forty pages are devoted to the localization and remedy of troubles. Part IV deals with arc dynamos, and Part V with railway motors.

Diagrams and illustrations are generously distributed throughout. The excellent way in which the material is arranged ought certainly to make this book appreciated by those who are in any way connected with the running of electrical machines.

TRADE CATALOGUE.

The Electrotherm. The H. W. Johns-Manville Co. have issued a small folder of the above title. Electric heating appliances have taken a permanent place in the equipment of the home, and especially is this true in the sick room. The Electrotherm is a substitute for the hot water bottle, and on account of its construction and the convenience for use at all times, affords a degree of comfort not otherwise attainable.

It is further claimed that the appliance has the approval of the National Board of Fire Underwriters.



ENGINEERING BUILDING, UNIVERSITY OF PENNSYLVANIA

DEDICATION OF THE NEW ENGINEERING BUILDING AT THE UNIVERSITY OF PENNSYLVANIA.

(By Herman W. Reynolds, Assistant Professor Mechanical Engineering, University of California.)

The dedication of the new engineering building at the University of Pennsylvania, which takes place on October 19th, is causing considerable interest in the engineering world on account of the publicity which is being given to the dedication ceremonies and the distinguished men who will be present, to say nothing of the building itself. Six foreign governments, the Army and Navy of the United States, and over a hundred scientific societies and educational institutions have appointed representatives to attend the ceremonies. Mr. Frederick W. Taylor, president of the American Society of Mechanical Engineers, and Dr. Alexander C. Humphreys, president of Stevens Institute of Technology, will deliver the principal addresses, and twelve distinguished engineers will receive honorary degrees.

The new building, which is to be occupied by the Departments of Mechanical and Civil Engineering, is the largest of the seventy buildings at the University, having a frontage of 300 feet and a depth of 210 feet at one end and 160 feet at the other. The cost, including equipment, approximates $1,000,000. Some unique features are shown in the design and equipment. The exterior is of dark brick, with limestone trimmings, and the architecture is of the English Georgian style. There are three stories, with a basement covering one-third of the entire building, the total floor area being 128,000 square feet. The heating is by direct steam; the ventilation is by electrically driven fans, located in the attic and basement, and the lighting by electricity. There are two principal entrances leading to a main hallway, which extends the entire length of the building, and the offices, of the heads of the departments, are placed between these entrances. Two large light-wells terminate in skylights over the first floor, thus giving ample light to the class rooms, lecture rooms and drawing rooms, which are located on the second and third floors. The basement contains locker rooms, lavatories, the heating and ventilating machinery and laboratories for hydraulic and goedetic work, and for the testing of materials of construction. The first floor contains, besides the main offices, the principal laboratories, such as the mechanical laboratory for steam, gas and water, the electrical laboratory, the dynamo laboratory, foundry, forge shop, pattern shop, machine shop, hydraulic laboratory and various rooms set aside for special work in mechanical, electrical and civil engineering. On the second floor are the reference library assembly room for students, class rooms, instructors' offices, and the drawing rooms. The drawing rooms are long and narrow, extending the entire length of the building and being well lighted from windows on both sides, the inside windows receiving light from above the skylights. The third floor is devoted principally to class rooms, instructors' rooms and drawing rooms. The drawing rooms are arranged and lighted as are those on the second floor. The third floor contains also an auditorium, a room for the use of the engineering societies, a library stack and museums.

A desirable feature, brought out in the design of this building, is the plan for the handling of small classes. The idea being to teach small classes, there are twenty-one small class rooms and only one large lecture room besides the auditorium and assembly room, which are available as lecture rooms. A teaching force of forty looks after this plan for handling small classes.

This building is the outgrowth of the increase in numbers in the engineering departments which has necessitated moving into larger quarters three times since the engineering department was founded in 1874. About 600 students are moving into larger quarters three times since the engineer-enrolled in the departments.

A LARGE ROOFING CONTRACT.

At Newell, W. Va., a new town on the Ohio river, opposite East Liverpool, O., the North American Manufacturin Co. are constructing several new buildings to be used as a pottery plant. The H. W. Johns-Manville Co. have secured the contract for covering the buildings of nearly the entire plant with their "J-M" asbestos roofings.

The makers of "J-M" asbestos roofings are to be congratulated upon the securing of the order, which will call for several thousand squares of material.

A QUIET WORD WITH THE HOTEL MAN

As a result of the enormous expansion of the electrical business in this country and the keen competition which has developed, thousands of men engaged in exploitation in this industry are now traveling, some regularly and some intermittently, from one point to another, covering the entire country.

This traveling includes not only apparatus and supply salesmen, but responsible officials and financial men as well—men who are handling the actual work of direction.

These men are all keen judges of electric lighting effects and are prone to judge a hotel by its electrical installation. They are the first to appreciate a good and well maintained system and to condemn a poor one.

Outside of the principal large cities, the electrical traveler, whose work takes him from one hotel to another, is impressed by the indifference frequently shown by the hotel management to this particular branch of the service. This is evidenced by the "sloppy" work of installation, cheap fixtures bent and fallen out of line, shades missing or sagging out of place, antiquated fittings, cheap lamps (cheap as to actual cost, but expensive ultimately), insufficient candlepower and so on, an almost endless list.

But the two greatest crimes to be charged against the unprogressive hotel man are his failure to properly place his lights at convenient points and to keep abreast of the time in his equipment. He is the first to offer the toothsome strawberry, prairie chicken and Blue Point when the season opens, but the last to take up with such substantial comforts as curling iron heaters, reading and desk lamps, automatic closet switches and room telephones.

One reason offered for this condition is that the entire electrical work in a great many hotels is left in the hands of an electrician who may be a competent wireman and familiar with all the eccentricities of the "juice," but is not the proper person to pass upon the fitting up of a room to be occupied by a man who lives in a $50,000 house when he is at home.

Hotel men will find food for thought in our article in this number descriptive of the electrical work in the Hotel Astor, New York City. While a general description is of great interest, one must occupy the position of a guest to appreciate the completeness of the system, the comfort which results and the important part electricity actually plays in the operation of this gigantic caravansary.

The Illumination of the Hotel Astor, New York City

(From "The Central Station.")

There are usually several ways of doing a thing well, and an infinite number of ways of doing it badly. If left to chance, therefore, it is nearly always done badly. A thing done well is prima facie evidence of study and care exercised in its doing. The illumination of the Hotel Astor is remarkably well done; and the philosophical observations just made apply with full force.

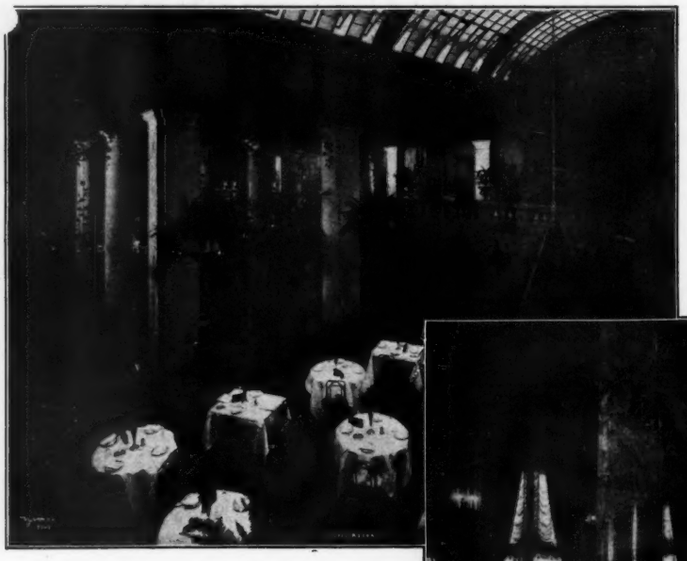
To be explicit; it is doubtful if there is another building of any kind in this country in which the illumination has been so carefully considered in all its phases as in this case. The building is one of the latest additions to New York's mammoth and magnificent hotel structures. It fronts the entire block on Broadway between Forty-fourth and Forty-fifth streets, and is a parcel of the property belonging to our late countryman, Wm. Waldorf Astor. The exterior appearance

NEW ASTOR HOTEL, USING "SUNBEAM LAMPS."

GUEST ROOM

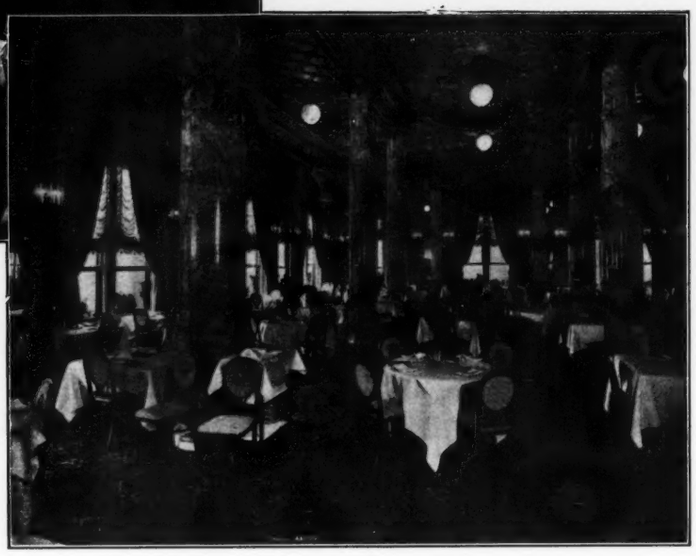
of the building speaks well for the general ability of the architects, Messrs. Clinton & Russell, as will be seen by a reference to the illustration. The interior is designed to meet every requirement of the modern hotel, including various dining rooms and cafes, ballroom, special assembly rooms, and probably the finest roof garden of the kind in the country. The problems involved in the interior illumination are, therefore, varied, and offer correspondingly great opportunities for either blunders or artistic effects.

The original installation was designed on a lavish scale, in accordance with the general high character of the building; but as so frequently occurs in such cases, when the



THE "ORANGERIE"

The light-sources are entirely hidden from view, being placed under reflectors covered with leaves and above the glass in the domes.



THE LADIES' DINING ROOM.

The bead spheres have been suspended by chains six feef from the ceiling, which has materially improved the general effect.

building was put to its destined use, it was found that in many respects the illumination was absolutely inadequate, and in practically all cases could be improved, either in regard to economy, or quality, or both. The whole subject, therefore, became a matter of continuous thought and study on the part of Mr. F. A. Muschenheim, with the result that many changes have been made, and others are still to be carried out. In this work he has had the co-operation of Arthur A. Ernst, a competent illuminating engineer of this city.

While the limits of this article will not permit of a general detailed description of all the illuminating appliances and methods used, an examination of some of the principal effects and defects will be instructive.

The lobby is formed by two halls 100 feet long crossing at right angles. The main, or Broadway entrance, and the "Orangerie" form the terminals of one of these halls, while the ladies' dining room and the gentlemen's cafe are at either end of the intersecting hallway. The ceilings are 20 feet high, and laid out in heavy paneling with gilt finish. A gallery runs along the rear of the intersecting hallway. The lighting of this lobby is by means of seven bowls of glass beadwork 36 inches in diameter, suspended 18 inches from the ceiling, and twenty 12-inch bead work spheres. There are also five Holophane bowls under the galleries. As bead work absorbs over half of the light, it was found that the original installation, consisting of twenty 16 candle-power lamjs, in each of the bowls, did not give sufficient illumination. Mr. Muschenheim hit upon the ingenious device of placing Pagoda reflectors inside of the bead work bowls, and in this way succeeded in so increasing the illumination below that he found it possible to replace the twenty 16 candle-power lamps with four of the new 50 candle-power high efficiency lamps. Assuming the 50 candle-power lamps to use 125 watts, this change effects a saving of 4,340 watts in the seven fixtures; but what is even more to the point, the illumination is now entirely satisfactory. The 12-inch balls were supplied with 8-16 candle-power lamps, also fitted with Pagoda reflectors. These have been replaced with one 50 candle-power high efficiency lamp and reflector, which effected a saving of 4,952 watts in the sixteen fixtures; making a total of 9,292 watts, or 12½ horsepower saving in the lobby alone.

The ladies' dining-room, shown in the illustration, has the same height of ceiling and is a rectangular room 68 feet long and 30 feet wide. This room was originally lighted with 14 large bead work balls attached directly to the ceiling. Each of these balls was supplied with 18 16 candle-power lamps. While these were intended to furnish the general illumination of the room, side brackets carrying small incandescents were provided for the sake of the decorative effect, and by increasing the number of light sources to add to the general cheerfulness of the room. To increase the illumination the same expedient was used in the lobby; the 16 candle-power lamps were replaced with six 32 candle-power lamps in Pagoda reflectors. Recently, also, the bead work bowls have been removed from the ceiling and dropped about six feet by means of heavy chain supports. This is an undoubted improvement, as it increases the illumination upon the tables, and reduces the light on the ceiling. Mr. Muschenheim is firmly of the belief that ceilings of all cases should be kept perceptibly darker than the lower portions of the room; and the results of his experiments in this direction certainly justify his belief.

The gentlemen's cafe (Hunting Room) at the opposite end of the hallway, has a novel and very pleasing arrangement of the lamps. As shown in the illustration, there are 12 chandeliers constructed entirely of elk horns at the various point of which 2-inch spherical frosted lamps of 8 candle-power are provided, each chandelier supporting about 20. There are also 22 side brackets carrying six frosted 16 candle-power tubular lamps. The large number of lights, and the

THE "HUNTING ROOM" (GENTLEMEN'S CAFE.)

originality of the fixtures, which are in such harmony with the spirit of the place, produce a most satisfactory impression.

In the rear, and opening directly into the lobby, is a dining-room which is called the "Orangerie," a name which is somewhat inappropriate at the present time, as the original decoration of orange trees in full fruit has been entirely removed. The room, however, is one of the most attractive dining-rooms in the city, and the lighting most unique. It is impossible to give an idea of the general beauty of the room and its illumination by any written description. The ceiling of the central portion of the room is laid out in deep panels between the supporting pillars. Across each panel there are a number of small beams a short distance below the upper surface; these are in the form of a trough on the upper side, and in these troughs, which completely hide them from view, are placed 16 candle-power lamps in Pagoda reflectors, the open end of the reflector being provided with a green tinted transparent screen. Thus a delicate green light is cast upon the ceiling above. The beams are also overspread with grape vines, giving to the whole the appearance of a magnificent grape arbor. From the main beam of the ceiling are suspended by drop cords a total of 143 16 candle-power lamps in Pagoda reflectors covered with grape leaves, so as to entirely hide both reflector and lamp. These furnish the illumination for the tables. At each end of the room the ceiling is raised into tunnel vaulting, which has cathedral glass set in the panels. Above the glass a number of Cooper-Hewitt mercury arcs are placed, which give a remarkable simulation of moonlight. A gallery runs entirely around the room. On one side of this gallery the walls are decorated with finely executed mural paintings, which are lighted by concealed Frink reflectors. The illumination of the gallery, which is also furnished with tables, is by 16 candle-power lamps suspended on short cords and covered with wisteria blossoms. A small fountain with statuary faces the main entrance, and this is lighted with a Cooper-Hewitt lamp. The only visible light sources are a few 16 candle-power lamps colored a delicate rose tint, and covered with Pagoda reflectors, placed on side brackets.

Occupying one corner of the first floor, and opening directly into the Orangerie, is a room intended originally as a billiard room, but now used as an extension of the cafe, and known as the Pompeian Room, from the style of the decorations. The room is fitted with five peculiar fixtures, which may be described as inverted umbrellas made of metal and heavy cathedral glass. They were dropped to reach within eight feet of the floor, and presumably were intended to light the billiard tables. Each was supplied with 20 8 candle-power lamps, which, due to the peculiar construction of the fixtures, threw most of the light toward the ceiling, illuminating it very slightly. **By substituting four 32 candle-power Sunbeam lamps, which make of lamp is used exclusively throughout the entire hotel, with Pagoda reflectors, the conditions were reversed and the desired results obtained.** The general illumination of the room is completed by 18 side brackets, and three opal bowls on a portion of the ceiling, that is lower than the main body of the room. The brackets are provided with two upright electric lamps and Holophane globes.

In the buffet there were orginally 36 16 candle-power bare lamps, studded about a large panel in the ceiling. These have been replaced with 8 candle-power lamps and small Pagoda reflectors, with the result that the illumination on the bar is much better than before. There are also about the room eight 5-light brackets fitted with 8 candle-power frosted spherical lamps, and three frosted glass bowls each supplied

with four 16 candle-power lamps on a portion of the ceiling that is lower.

In the basement, reached by a broad stairway from either end of the lobby, is the American Indian grill room. This room is 22x100 feet, with a low vaulted ceiling. In the original installation, lanterns, or balls, made up of smoked mica set in an iron frame work, are attached to the intersecting points of the vaulting, each containing eight 16 candle-power lamps; but even with this excess of light the absorption of the smoked mica was so great that the tables were in comparative darkness. These have been replaced with a small neat iron fixture having six pendant 8 candle-power lamps with small Pagoda reflectors. The result is an illumination that is practically perfect for the purpose, being perfectly uniform, and the sparkle of the light in the reflector adding a cheerfulness to the room that can be obtained in no other way. When the lanterns were removed, it was found that the insulation on the wiring was charred and brittle, in some cases to such an extent as to make short circuits, due to the excessive heat from the numerous lamps.

Above the landing of the stairway leading to this room there is a handsome wall painting. This was originally lighted with two 16 candle-power lamps in a mirror-lined trough reflector, such as is frequently used for such purposes. This has been replaced with a single 16 candle-power lamp in a Pagoda reflector with cardboard shade, and the illumination of the picture is perfect. This shows how carefully every detail in the lighting has been examined and improved where possible.

In the hallways leading to this room there were originally 10 and 12-inch frosted globes containing five 16 candle-power lamps; these are now supplied with one 75 candle-power high efficiency lamp, which gives much better results.

The ball and banquet room is on the eighth floor, and is 75x55 feet, with high ceiling. The decorations are in light tints and gilt. The illumination is by means of eight candeliers, or rather large bowls of bead glass work, with a festoon of bead glass above them, and suspended from the ceiling to within ten feet of the floor. Each of these chandeliers is provided with 32 16 candle-power incandescent lamps distributed in the bowl and within the festooned bead work above. Within the window casing at the side, which light the curtains and thus add greatly to the appearance of brilliancy to the room. These lamps are entirely out of sight.

At the outer end of the main hallway on this floor are a number of private dining or assembly rooms, finished in different characteristic forms of decoration. The largest of these is called "College Hall," the wall decorations representing various scenes in the game of football. The illumination was originally by bead work bowls containing 20 16 candle-power lamps; but these have been reduced to 12 lamps with Pagoda reflectors.

The hallways leading to the rooms have been the subject of special care on Mr. Muschenheim's part. As the doors are provided with transoms, great care has been taken to prevent light from entering the rooms. The lighting is by means of side brackets furnished with two pendant lights. In order to reduce the light in the rooms, the lamps were first cut down from 16 to 8 candle-power, and finally the brackets have been supplied with Pagoda reflectors, having paper shades on the outside, so as to entirely cut off the upward light. By this means the floor of the hallways is lighted sufficiently to make passage through them easy, while practically all direct light is cut off from the ceilings and thus prevented from entering the rooms.

The rooms themselves are the best lighted we have ever seen in a hotel. Their average is 11x19 feet. The general illumination is by a three-light chandelier placed very near the ceiling, the three lamps being fitted with Pagoda reflectors, as shown in the illustration. This gives a practically uniform illumination throughout the entire room; and to provide special illumination a two-light bracket, also fitted with reflectors, is placed above the dresser, and table lamps for writing and reading. One of these table lamps is fitted with a Hylo lamp, which can be used as a night lamp for those accustomed to a faint light in their room during the night.

The top of the building is used during the summer as a roof garden, being fitted out in the style of an Italian garden. The artificial light here has purposely been kept very dim, so as not to obscure the magnificent view of the city, the river and the Palisades beyond, which affords a panorama of unsurpassed beauty. This remarkable garden is furnished with an abundance of growing shrubbery, banks of blossoming plants, and cascades of running water. The top of the building is outlined with a double row of large globes on pedestals, as shown in the illustration of the building. A similar row of pedestal lights is also placed along the inner edge of the sidewalk. Where these originally contained eight 16 candle-power lamps they are now supplied with one 75 candle-power high efficiency unit, with far better illuminating results. The frosted globes have also been replaced with opaline, which does not collect dust and show soil like the ground glass.

Taken altogether, this building furnishes perhaps the best example of the practical advantage of handling illumination as an engineering problem. The primary object in the changes was to improve the illumination, which in many cases was so unsatisfactory as to make a change imperative; but it is especially worthy of remark that in every change made, not only has the illumination been brought up to a satisfactory condition, but a material saving in electric current has been effected at the same time. While this saving in current may not show so plainly in the running expenses as it would were the current being purchased by meter, nevertheless, the reduction throughout the building when all changes have been made, will be so large as to readily make itself felt in the coal bills.

The question also arises, in case a building, presumably constructed in accordance with the most advanced modern ideas and with the best of equipment and construction, proves a failure in so important a respect as artificial illuminations, as to where the responsibility is to be placed. Evidently not with the electrical engineers, for the means of generating the current and of supplying it where required, seem to be entirely satisfactory. The fault must then be laid to the doors of either the architects or the decorators—if the decoration was given as a separate contract. The simple cost of the changes that have already been made, to say nothing of the economies that will be continuous hereafter, would amount to a very respectable fee for a consulting illuminating engineer. Thus, what Stevenson said of the mechanical engineer will hold equally true of the illuminating engineer: **"The services of a competent engineer are not an expense, but an economy."**—*From Energy*.

PERSONAL.

The Rix Compressed Air Drill Co. are again established in San Francisco and are located in connection with Henshaw-Bulkley Co. at 219-221 Spear street. Mr. A. E. Rix, the president, may be found there from 1 to 4 in the afternoon.

TRADE NOTE.

The Dean Electric Co. report that their Kansas City branch has received such an increase in business that it has become necessary to move to larger quarters. They will occupy the entire ground floor of the Waterworks building, corner Sixth and Walnut streets. Mr. L. G. Bowman, who has had a wide experience in the manufacture and sale of telephone apparatus, has charge of this office as Western manager, and they further state that they will carry the largest stock of telephone equipment west of the Mississippi river and will be in a position to ship the same day orders are received.

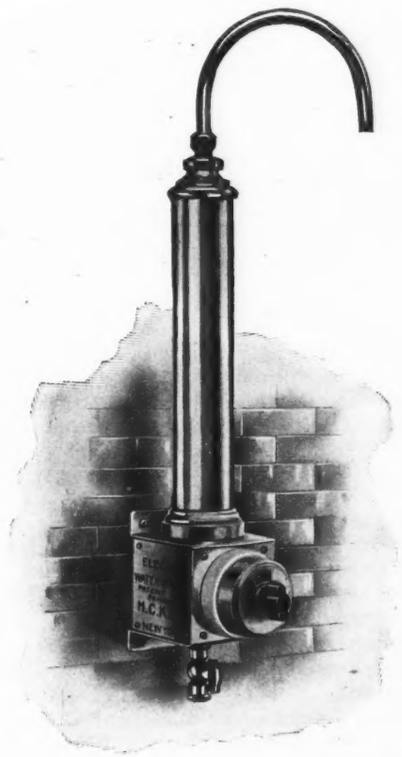
INDUSTRIAL

H. C. K. INSTANTANEOUS ELECTRIC WATER HEATER.

In the earlier type of electric heaters the heating element, usually consisting of a resistance wire wound upon a suitable insulating frame, was placed within the tool or appliance to be heated. A certain amount of air space always surrounded the heating element, therefore the heat was never transmitted directly to the heating surface of the appliance. This indirect transmission of heat from the heating unit was found to be extremely inefficient, and the efficiency of the heater was further reduced on account of the limited temperature at which the resistance wire could be operated in the air.

Both the efficiency and the lasting qualities of the modern electric heating appliances have been materially improved by imbedding the heating element in an insulating compound which protects it from the atmosphere, permitting a much higher temperature than would be possible in the open air. The insulating compound, in addition to insulating and protecting the heating wire or strip, also serves as a much better medium than the air for transmitting the heat to the heating surface of the appliance, with which it is in direct contact.

The efficiency of many modern heating appliances has been improved to a high degree, but the amount of power required is still considerable, and the most serious objection lies in the fact that the operation of the device is too slow.



Keeping the above in mind, and after considerable experimenting, and many tests conducted during the past year, the H. C. K. Co., 45 Broadway, New York City, has produced a new form of electric heater for heating water instantaneously. Estes Electrical Co. are Pacific Coast agents.

It was found during the tests that it would be impossible to heat water instantaneously by any other method than direct contact between the water and the heating element. This form of heater was then developed, but while the efficiency could be maintained extremely high and the heating of the water could be made as rapid as desirable, the life of the heating element depended altogether upon the presence of the water. The problem was solved when an automatic cut-out was applied to the electric water heater which would interrupt the current when the water ceased to flow, or if the flow should be reduced to such an extent that the water in the heater would boil.

At first sight, it might appear that the water flowing through the heater around the heating coil would introduce a ground on the electric system. This is, however, not the case, as insulating joints are provided at top and bottom of the heater tube and the resistance of the water is sufficiently great to prevent any flow of current. Where the heater is connected to the regular Edison three-wire systems, the neutral, or grounded connection, is connected to the lower part of the heater, which absolutely prevents any grounds, as there can be no difference of potential. This is also the case where the heater is used on alternating systems where one side or the neutral of the secondary circuit is grounded.

The H. C. K. instantaneous electric water heater consists in the main of a supporting box, upon which is mounted a double pole quick break switch, an insulating joint of special design, to the lower end of which is attached a ¼-inch water valve. Screwed into the upper part of the insulating joint is a bronze fitting, within which is placed the cut-out which automatically opens and closes the electric circuit as the water is turned off and on. In the upper end of the bronze fitting there is held (in a similar manner as is a water glass for a boiler) a porcelain tube, with one terminal at each end. Within the porcelain tube is placed the heating element, which consists of a specially designed spiral, made of a material which is guaranteed not to rust or corrode, or be injured in any way by the action of the current and the presence of the water. At the upper end of the porcelain tube there is another bronze fitting with insulating joint above it which supports the spout. One wire leads from the switch to the upper bronze fitting on the porcelain tube, and the wire from the other side of the switch leads to the lower bronze fitting. The porcelain tube and the bronze fittings are surrounded by a brass tube 1¾ inches in diameter. The total height of the heater from the bottom of the inlet valve to the top of the spout is 20 inches, and all fittings are nickel plated and highly polished.

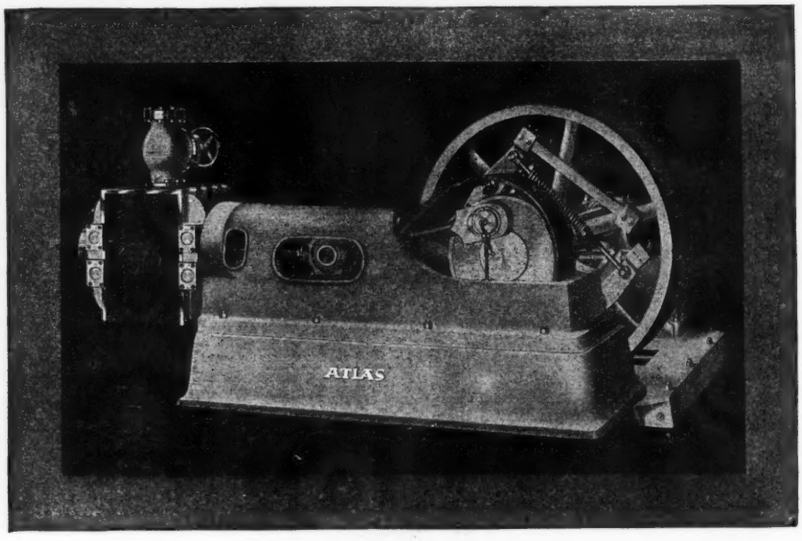
The standard heater requires about 10 amperes at 110 volts, and will heat a glass full of water to 190 degrees F. in 40 seconds, which at the rate of 10 cents per 1,000 watts would cost .014 cent. The same heater would heat one gallon of water to the same temperature in 10 minutes for less than 2 cents. For an ordinary washstand there would be required about one quart of water at about 105 degrees F. The heater would require 40 seconds to heat this water and the cost would be less than .014 cent.

The H. C. K. electric heater is made in several sizes, from 10 to 25 amperes at 110 volts, and 5 to 12 amperes at 220 volts, for either direct or alternating current of any frequency. The 10-ampere size will heat one glass of water to 190 degrees F. in 40 seconds, and the 25-ampere size will heat one glass of water to the same temperature in 15 seconds.

The design and construction of the heater is such that central station operators need not hesitate in recommending the device to their consumers.

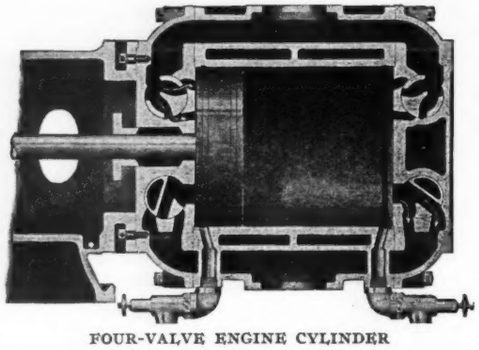
AN ADVANCE IN STEAM ENGINE DESIGN.

In meeting the invasion of the power field by new prime movers and long-distance electrical transmission of water power, the steam engine has held its own, and has even increased its field of usefulness by rapid improvement in both efficiency and simplicity. One of the best examples of this new era of progress in steam engineering is the new Atlas four-valve engine manufactured by the Atlas Engine Works of Indianapolis.



ATLAS FOUR-VALVE ENGINE

In the effort to produce an engine that would be simple, durable, and highly economical of steam, the Atlas designer has turned for economy to the Corliss principle of separate, semi-rotating valves for inlet and exhaust, and has improved on the Corliss economy by placing the valves directly in the cylinder heads, thus giving the shortest possible steam passages, the least possible condensation, and the lowest clearance, while he has lost but little of the economy by stripping the gear of all such complications as dash-pots, wrist plates, governor cams, crab-hooks, and rocker-arms with their offsets and lost motion. A shaft governor is used, and the two steam valves are operated by one rod directly from an eccentric, which is a part of this shaft governor.

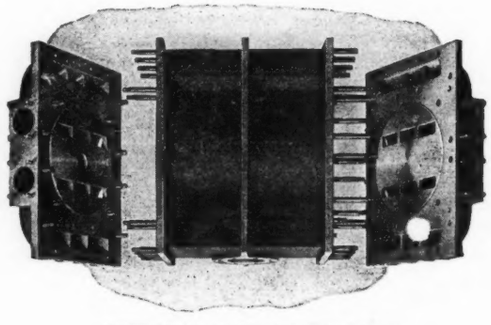


FOUR-VALVE ENGINE CYLINDER

The two exhaust valves are operated by a rod from an eccentric which is keyed to the shaft. The operation is thus as thoroughly simple as that of the slide-valve engine, and experience has shown that it is no more likely to get out of order, and requires no more expensive attendance, than does the ordinary automatic single-valve engine.

Exhaust valves have always been operated in this way on the Corliss, and it has been demonstrated by the Atlas that with a shaft governor that is just right and correctly proportioned valves and ports, backed by the nicest accuracy of workmanship, a cut-off practically as precise and a regulation as close, can be had with this simple four-valve construction as with the delicate and complicated mechanism of dash-pots and releasing gear that is essential to the Corliss.

The engine has removable journals and is built in sizes varying from 10-inch to 26-inch cylinders, in both self-contained and side-crank forms of transmission, with splash or sight-feed oiling systems. The speed range recommended runs from 125 to 250 revolutions per minute according to the size of cylinder and length of stroke, and the engine finds its field of usefulness limited only by its speed limits.

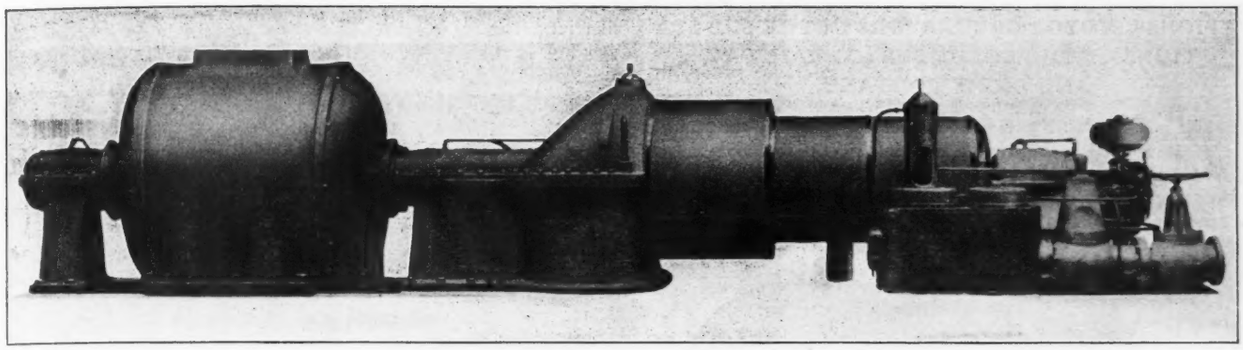


SECTIONAL VIEW OF CYLINDER

PERSONAL.

Mr. Richard S. Buck, Am. Soc. C. E., who is at present consulting engineer of the Department of Bridges, New York City, has just become a member of the New York firm of Sanderson & Porter, engineers and contractors. Mr. Buck is just now engaged on the Manhattan and Blackwell's Island bridges, and will not sever his connection with this work for some time at least.

The above firm, which now consists of Messrs. Edwin N. Sanderson, H. Hobert Porter, Francis Blossom, Richmond Talbot and Richard S. Buck, are engaged, in addition to a number of large engineering enterprises all over the country, in the general design and construction of two hydro-electric plants on the Pacific Coast, comprising about 50,000 horsepower of equipment.



HORIZONTAL STEAM TURBINE

THE TREND OF STEAM TURBINE MANUFACTURE.

In a bulletin on "Steam Turbines and Generators," which the Allis-Chalmers Co. of Milwaukee is about to issue, that company gives the reasons which led it to adopt the reaction turbine of the horizontal type as the most efficient and the one best adapted to operating conditions. The steam turbine, which was looked upon as a mere mechanical toy only a few years ago, has proved itself in certain fields of power generation a successful rival of the reciprocating engine.

The impulse type differs from the reaction type in that the steam, before doing any useful work, is passed into nozzles of various shapes, its pressure being considerably reduced while it acquires a high velocity before acting upon the revolving buckets or blades. In some constructions there is only one row or ring of revolving buckets and the turbine runs at a very high speed proportional to that of the steam, thus necessitating the employment of gearing to reduce the speed to workable limits. In other constructions two or more rows of buckets are used, each of which absorbs a part of the high steam velocity, thereby reducing the turbine speed. For the purpose of obtaining a better economy, in the newer impulse turbines, the steam is passed through several successive sets of nozzles and their subsequent rows of buckets, necessitating a very careful adjustment of the pressures and velocities by the accurate proportioning of nozzles and buckets, and the regulation of the turbine speed.

In the reaction type the steam acts directly upon the blades without initial reduction in pressure, except such as may be effected by the governor in securing speed regulation. The steam flows between a large number of rows of blades, alternately stationary and revolving. Guided by the stationary blades upon the revolving ones, the steam expands continuously throughout the length of the turbine, alternately gaining velocity and imparting it to the rows of blades, partly by impulse, but to a greater extent by the reaction as it issues from between the revolving blades. There is no violent change in pressure at any time; the reduction seldom exceeds three pounds at any one row of blades, and the velocities are therefore comparatively small.

In deciding upon the reaction type of turbine the Allis-Chalmers Co. was influenced not only by the large number of that type in successful operation and its superior economic results in actual practice, but also by the fact that the reaction turbine will maintain its original steam economy after long service, principally because the steam velocity in this type is less than one-fourth of that in the impulse turbine, for the erosive action of steam increases approximately as the square of its velocity.

Another important point, which was carefully considered, was the best arrangement for the turbine, whether the vertical or the horizontal. Investigations seemed to show that the horizontal type was preferable, notwithstanding that the vertical type can be built at a somewhat lower cost.

The vertical type requires a step bearing with lubricants supplied under pressure, a thing to be avoided whenever possible. Moreover, the electric generator has to be located in the worst possible position, above the turbine, where it is exposed to the heat arising from the latter, together with what steam may leak past the shaft glands. Then, too, it is difficult to protect the generator from oil thrown from the upper bearings. Added to this is the inaccessibility of the vertical type for the occasional overhauling which is needed by even the best machinery. In the horizontal type the whole of the apparatus, turbine and generator, can be taken apart and reassembled in a comparatively short time, and the turbine and generator can be worked upon simultaneously by different gangs of men. In the vertical type, on the contrary, the machine has to be taken apart piecemeal, beginning at the top, and after the generator has been removed the various discs of the rotating element of the turbine have to be stripped from the shaft one by one.

Both types have some disadvantages. Whether one will entirely give way to the other is a matter which at present can only be conjectured.

OF COMMERCIAL INTEREST.

The Dean Electric Co., Elyria, Ohio, has just been awarded a contract to install a modern telegraph equipment, test board and toll boards for the United States Telephone Co., Cleveland, Ohio. When completed, this installation will include one of the most modern long distance toll, operating and test boards yet devised for simultaneous telegraph and telephone work. Among the many other contracts recently received by this company is one from the Los Angeles Home Telephone Co. for a 5-section mahogany toll board to be placed in connection with the old board now in operation, which was installed by the Kellog Switchboard & Supply Co.

The Electric Controller & Supply Co., Cleveland, Ohio, announces the opening of a Chicago office in the Merchants' Loan & Trust Building, 135 Adams street, Chicago, Ill., with Mr. W. M. Connelly in charge. Mr. Connelly was connected with the electrical department of the Homestead works of the Carnegie Steel Co. for five years and resigned his position there to become electrical engineer of the Ensley plant of the Tennessee Coal, Iron & R. R. Co. at Birmingham, Ala., which position he held for three years, and resigned to enter central station work at Birmingham, Ala., and at Houston, Tex., where he organized and had charge of the sales department. Mr. Connelly enters upon his new duties fully equipped to take care of the interests of the Electric Controller & Supply Co. in the Chicago district.

Recent sales of the Crocker-Wheeler Co. in the West are:

One 20 horsepower direct connected motor, 500 volts, 820 revolutions per minute; one 45 horsepower direct connected motor, 500 volts, 1,000 revolutions per minute, to the American Smelting & Refining Co., Pueblo, Colo.

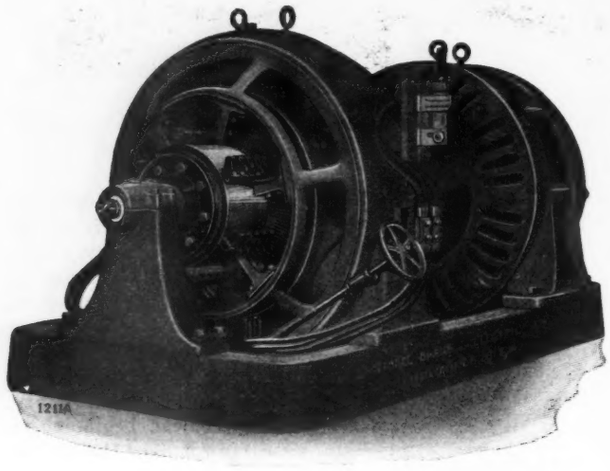
One 45 horsepower direct connected motor, 225 volts, 925 revolutions per minute, to Arkansas Valley plant, Leadville, Colo.

One 45 horsepower direct connected motor, 230 volts, 925 revolutions per minute, to Eilers plant, Pueblo, Colo.

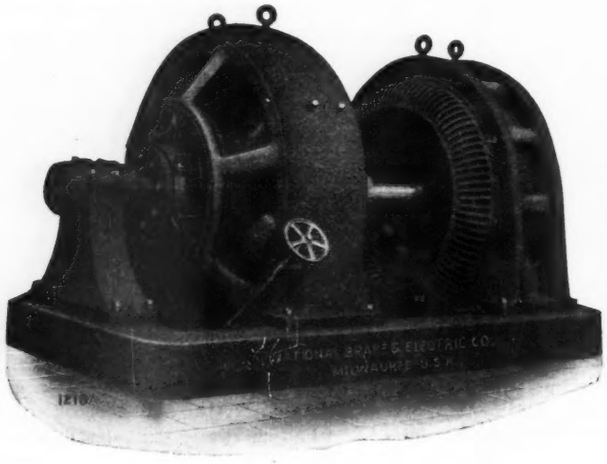
Two 20 horsepower direct connected motors, 500 volts, 820 revolutions per minute, to the Globe plant, Denver, Colo.

NATIONAL MOTOR-GENERATORS IN THE SUB-STATIONS OF THE COLUMBUS (O.) RAILWAY AND LIGHT COMPANY.

The power plants and systems of this company are among the most modernly equipped stations in the central West, embodying as they do all the newest and latest practice in



equipment and operation. The company was incorporated in Ohio in 1903 and acquired by lease the Columbus Railway Co. and the Columbus Edison Co. On July 1, 1906, the company also acquired operating control of the Central Market Street Railway, which was one of the Appleyard properties, but was obtained by the Ohio syndicate at a receiver's sale. The Central Market Street Railway owns 16 miles of track and leases 15 miles. The Columbus Railway & Light Co. owns 107 miles of track, making a total of 138 miles in the combined system.



The system consists mainly of broad-gauge lines, on which 331 cars are operated. On the standard-gauge lines about 60 cars additional are operated, making a total of nearly 400 cars in use. The majority of these cars are equipped with General Electric 67 motors, with a scattering of General Electric 52 and 800 and Westinghouse 12 and 49.

Current for operating the railway and lighting system is generated in four stations, with an aggregate output of 10,000 kilowatts. The smallest of these is the Milo station, just outside of the city limits, which has a capacity of 800 kilowatts. The Milo station has within the past month been converted into a sub-station, and a National 500 kilowatt motor-generator set installed to supply current to the system in this district. This set is of the three-bearing type and consists of a 750 horsepower 3-phase 60-cycle 600 revolution per minute synchronous motor, receiving current at 4,100 volts and driving a 500 kilowatt direct current generator which generates current at 575 volts and 870 amperes. The construction of these machines provides for a liberal rating and low temperature rises and at the same time gives a compact set of very rugged appearance and graceful lines.

The Columbus Railway & Light Co. has also recently installed a National induction motor-generator set in a new sub-station at the corner of High and Town streets. This set is used for bridging in on the underground Edison lighting circuit. This set comprises a 375 horsepower motor wound for 3-phase 60-cycle 4,100-volt current and driving a 250 kilowatt 250-volt direct current generator at a speed of 720 revolutions per minute. The present connected lighting load of the company is about 150,000 16-candle-power lamps. In the business section of the city the lighting system is underground.

ELECTRICAL EQUIPMENT FOR THE HUDSON CO.'S TUNNELS.

The electrification of the Hudson Co.'s tunnels under the North river, which connect Jersey City with New York, has just been actively undertaken, the work of construction having been completed nearly a year ago. It is the intention to operate 50 electric cars, which will take their power from a third rail. Each tunnel will have a single track, the north tube carrying the west-bound traffic and the south tube carrying the east-bound or New York traffic. The cars will be operated in trains by the Sprague-General Electric system of multiple unit control in a manner similar to that employed on the New York subway trains. Each car will be equipped with two General Electric 76 (160 horsepower) railway motors. Power for this new development will be supplied from a large station on the New Jersey side, located between Jersey City and Newark. Curtis steam turbines will be employed, initial equipments including two 3,000-kilowatt 11,000-volt machines and two 6,000-kilowatt 11,000-volt machines. The total power so generated will be distributed at high voltage to three sub-stations, where the alternating current will be stepped down to 650 volts direct current through transformers and rotary converters. These sub-stations will be located as follows: Sub-station No. 1, Greenwich and Christopher streets, New York, containing five 1,500-kilowatt rotary converters and 15 step-down transformers; sub-station No. 2, Washington and First streets, Jersey City, containing four 1,500-kilowatt rotary converters and 12 step-down transformers; and sub-station No. 3, Cortlandt and Church streets, New York City, containing two 1,500-kilowatt rotary converters and six step-down transformers. Each sub-station will, in addition, contain one spare 1,500-kilowatt transformer.

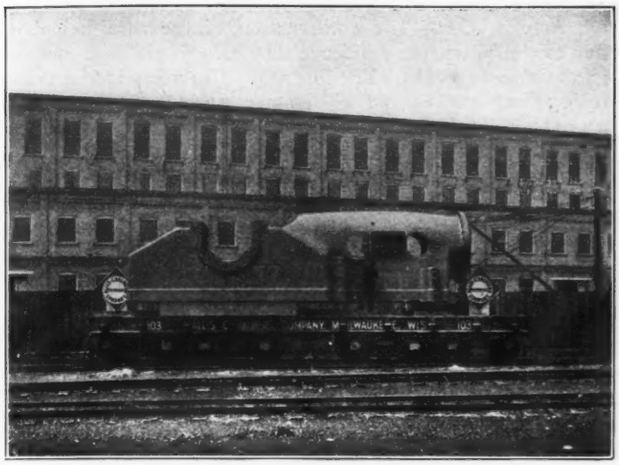
It is expected that when the new line is in operation the running time between New Jersey and New York City will be reduced one-half. The General Electric Co. will furnish the complete electrical equipment.

POWER AND LIGHT PLANTS.

Everett, Wash.—The Everett Railway, Light & Power Co. will erect a power plant a mile north of Granite Falls to develop 400 horsepower. Estimated cost $350,000.

Dawson, Y. T.—The Canadian Klondike Co., Ltd., will expend $600,000 next season in the installation of a giant power system in the Twelve-Mile district. Sigmund Rothschild, president.

Roseburg, Ore.—The Myrtle Creek Water, Light & Milling Co. has been incorporated with a capital of $20,000 by C. O. White, T. R. Sheridan and A. M. Kelsay. The company will establish a water and light system in Myrtle Creek and will extend system to Riddle and neighboring towns.



A MONSTER CASTING.

The accompanying photograph shows a slide and bed plate, cast in a single piece and weighing 105 tons, which will comprise a portion of the 4,000 horsepower tandem rolling mill engine which the Allis-Chalmers Co. is constructing for the Edgar Thomson Works of the Carnegie Steel Co. The pattern for this huge casting measures 32 feet long, 11 feet wide and 10 feet in height, and represents the work of ten expert pattern makers working steadily for a period of over four months. The amount of lumber used in its construction aggregated the unusual figure of 22,000 feet.

The pit, in which the casting was poured, measured 40 feet by 15 feet by 11 feet deep. It required less than ten minutes to pour the 108 tons of metal necessary for the rough casting. Nine ladles were employed, four with a capacity of 25 tons each, one of 13 tons and four of 5 tons each, aggregating 133 tons.

Special precautions were, of course, necessary in removing the casting from its pit. Three cranes, with ample overload capacities and rated aggregate of 145 tons, were used in conjunction. A special tackle, applied at the ends of the heaviest of trussed steel lifting bars, was devised so that the lifts should be straight upward.

Fifteen days were allowed for cooling before the operation of cleaning was begun. Even after cooling for twenty days, the heat given off by the casting could be felt several feet away. During the cleaning process three men, standing upright, were able to work inside the slide aperture without crowding.

To transport this heavy mass to the Edgar Thomson Works, it was necessary to construct a car of unusual capacity. This one is supposed to be the first of its kind. It is 40 feet 2 inches long and is mounted on four trucks of four wheels each. Its normal capacity is given as 100 tons.

THE ELECTRIC MOTOR IN CLOTH PRINTING ESTABLISHMENTS.

A very important factor in the successful operation of a cloth printing machine is to be able to regulate the speed according to the particular requirement of the work in hand. The machine itself consists of a large revolving cylinder which bears against several copper rolls, called printing rolls, upon which the design has been engraved. The number of rolls depends upon the number of colors used, since each color requires a separate roll. The cloth is passed between the cylinder and the rolls, receiving the imprint of the design from the copper rolls, which take their color from troughs into which they dip. From the printing machine the cloth goes through a drying room, heated by steam to a high temperature, from where it emerges with the ink entirely dried, provided the speed of its passage through the drying room has been properly timed.

When using but one color, different speeds may be required, according to the character and thickness of the cloth, in order to effect the proper setting of the color. With a number of colors, which usually means an intricate pattern, a certain definite speed is necessary in order to obtain the proper register as well as the setting of the colors.

The multiple voltage system of electric drive is admirably adapted to this class of work. The printer finds it of particular advantage in "making ready," which usually consumes much time in getting the proper register and in determining the proper pressure of the rolls to insure good setting of the ink. For this work very slow speeds and quick starting and stopping are a necessity. Once he has all the adjustments made and has determined the proper speed for the work in hand, he lets it proceed, noting on the controller the notch at which he desires to run, so that if it is necessary to stop the machine, it can be instantly set to work again at the same speed without loss of time.

Previous to the adoption of electric motor drive, the printing machines have each been driven by a twin-cylinder engine, direct coupled to the main driving shaft of the machine, the variation in speed being obtained by hand throttling. The printing room was invariably a dirty, oily, damp place. The inefficiency of these engines, together with the large amount of condensation in the long steam pipes between boiler room and printing room, created a condition of power extravagance against which the electric motor drive has produced most favorable results in economy. The exhaust steam from the engines has in some cases been used for the heating of water, through indirect contact, for use in the dye houses, but the economy of the electric drive is so great that the live steam used in place of the exhaust from the engine is not a matter of much consideration.

On account of the very slow speeds required at different times, the four-wire multiple-voltage system is better adapted than the three-wire system. To obtain the slowest speeds, a few steps of armature resistance are used and this has necessitated the development of a special type of controller. One of these, manufactured by the Allis-Chalmers Co., gives 18 speeds, the lowest of which are obtained through the use of armature resistance. This resistance also has another use, since the throwing of even 50 volts on the motor armature for the first speed would cause a too sudden jump and result in tearing the cloth. An 18-speed controller meets the conditions for all ordinary work, although for a recent installation for the Glenlyon Dye Works a new 41 speed controller was designed and is now in successful operation.

The usual method of installing a printing machine is to place the motor on the floor below the printing room and belt up to a driving pulley on the main shaft of the machine. In some installations the motors are all located on a balcony above and to the rear of the row of printing machines. To save room, the most convenient method of locating the controller is to mount it on the ceiling of the floor below the printing room, the shaft of the controller being extended above and with the hand wheel at a convenient height in front of and to the right of the printing machine.

The power necessary to drive printing machines depends upon the number of colors for which it is built and the pressure necessary to force the ink into the cloth being printed. For a machine built for three colors, a ½ horsepower motor is usually sufficient.

The multiple-voltage system has also found favor in driving other machinery in textile finishing works, such as soapers and tender frames, the latter being used to stretch and straighten the cloth. Soapers require a motor of approximately 18 horsepower at 900 revolutions per minute, and a 12 horsepower at 900 revolutions per minute is ample for tender frames, the motor in both cases being direct coupled to the machine.

Several New England plants are now operating their machines by the multiple-voltage system, with a considerable saving in power and floor space, and with a noticeable improvement in the cleanliness of the printing rooms.

News Notes.

ELECTRIC RAILWAYS.

The Big Bend Water Power Co., which controls 28 miles of water rights below Spokane, Wash., has been reorganized with a capitalization of $2,000,000 and will build an electric line from Spokane to Coeur d'Alene, Idaho, thence into the Coeur d'Alene district, connecting all the mining camps, the entire mileage being 154 miles. Thirty thousand horsepower can be developed at the company's plant, for the equipment of which orders will be placed early in November.

The Spokane (Wash.) Interurban Railway Co., with a capital of $150,000, has been incorporated in that county and state by H. L. Bleecker and others of Spokane, and will at once build a line between Hayford and Cheney, six miles. It will use the Washington Water Power Co.'s Medical Lake line from Spokane to Hayford, 10 miles. The company has secured the necessary franchises and right of way. Mr. Bleecker is secretary of the Washington Water Power Co.

The Colville & Eastern Railway Co. of Orin, Stevens Co., Wash., north of Spokane, has been incorporated with a capital of $100,000 by C. T. Winslow, L. C. Jesseph and S. Douglas. The line will connect with the Spokane Falls & Northern, a Hill property, and will extend into the southeastern part of the county, giving the farmers and fruit growers of that section direct connection with Spokane markets. Mr. Jesseph announces that work will be pushed.

Work on the Spokane & Inland Electric Railway Co.'s line between Spokane and Colfax, Wash., is being rushed, and it is expected the service to the last-named city will be opened some time the coming month. Much of the bridge work has been completed, and it is given out that the road will be extended to Lewiston, Idaho, to form a water connection on the Snake river.

Everett, Wash.—W. J. McAllister and O. O. Rowland of Seattle have made application to the county commissioners for a franchise for an electric road and for the erection of telephone and telegraph lines, also for the authority to lay pipe lines between the towns of Index and Mineral City.

Centralia, Wash.—The Centralia Electric Railway & Irrigation Co. has incorporated, with a capital of $50,000, by Theodore Hoss, John D. Saunders, Chas. Smith and Fred T. Camp.

New Westminster, B. C.—The British Columbia Electric Ry. Co. has a $1,250,000 extension scheme under way, General Manager Puntzen having approved the plan to build an electric line from this city to Chilliwack, a distance of 45 miles.

Spokane, Wash.—The Washington Water Power Co. will extend its Cannon Hill line through Cliff Park.

San Francisco, Cal.—The Peninsular Ry. Co. is building a double track electric railway connecting Los Gatos and San Carlos, a distance of 50 miles.

Seattle, Wash.—The Seattle Electric Co. was granted a permit for putting in two sidetracks, one on Beacon Hill, on Fourteenth avenue, between Holgate and Grand street, the other on Main street, between Ninth and Tenth avenues.

Tacoma, Wash.—The Tacoma Ry. & Power Co. has decided to build a car barn 170x250 feet on Puyallup avenue.

Tacoma, Wash.—The Tacoma Ry. & Power Co. is to build a line to Bismarck.

Wenatchee, Wash.—Work on the preliminary survey for the proposed Big Red Apple route, to be built between Wenatchee and Leavenworth, will begin September 24.

Boise, Idaho—The Boise Traction Co. is extending its tracks eastward on Warm Springs avenue to the penitentiary grounds.

Bellingham, Wash.—Stone & Webster will make a preliminary survey this year for an interurban project through Skagit county.

TELEPHONE.

Astoria, Ore.—The construction of the rural telephone line to the Warnstan residence near Olney will be completed in about three weeks. The line will be 13 miles in length and have 15 subscribers, and will connect with the city exchange.

Astoria, Ore.—The Home Tel. Co. will soon begin the installation of an automatic system at this place.

Aberdeen, Wash.—The construction engineer has arrived to make preliminary surveys for installing an independent service by E. C. Finch.

Butte, Mont.—The Rocky Mountain Bell Tel. Co. will extend their line to Blackfoot at once and possibly to Miles City.

Bellingham, Wash.—In behalf of the Farmers' Tel. Co. an injunction was served on the Wahl and Sunset Tel. Co. restraining them from interfering with the Farmers' line. The Home Tel. Co. will at once install 25 instruments in the city.

Albert Held, architect of Spokane, Wash., has completed plans for headquarters of the Home Telephone Co. in Spokane to cost $60,000. The structure will be of reinforced concrete, fireproof, and is to be completed in May, 1907. It will have a frontage of 71 feet, with a depth of 100 feet, two stories high and basement. A sub-station to cost $5,000 will also be erected in Spokane. The automatic switchboard will be installed on the second floor of the main building. It is given out that work will begin about the middle of this month.

Ashland, Ore.—The Western Union Co. will shortly begin the construction of line on the Weed road.

Astoria, Ore.—A contract was let to Hille Leikel by residents of the Young's River district for the construction of a rural telephone line. The line, including branches, will be 13 miles in length.

Eugene, Ore.—The farmers on Indian creek are building a 16-mile system. The line is called the Indian Creek and North Fork Farmers' Line. J. J. Wilkinson, president.

New Westminster, B. C.—The British Columbia Tel. Co. is contemplating the erection of an office building and the installation of the latest and most improved type of switchboard.

Pasco, Wash.—The Independent Tel. Co. has secured a franchise at this place and will put in an exchange.

Portland, Ore.—The Northwestern Long Distance Tel. Co. is negotiating with the Milwaukie council for a 25-year franchise.

Spokane, Wash.—The Independent Tel. Co. has its chief engineer, H. A. Zahm, in the Big Bend country with a view to putting in a line to compete with the Sunset Tel. Co.

Bellingham, Wash.—The Sunset Tel. Co. has completed its conduit work with the exception of laying the cable. The switchboard and other equipment for the new station will arrive this week.

Bellingham, Wash.—The Home Tel. Co. will extend their line to Silver Beach, Rusticana and other ports on Lake Whatcom.

Edmonton, Alta.—Plans have been received from Miller & McMeen of Chicago for the new telephone building, to be 50x75 feet; also plans for a conduit system cable and distributing systems.

Georgetown, Wash.—The Northwestern Long Distance Tel. Co. was granted a franchise to run its line through the city on Charlestown and Commerce streets.

Coeur d'Alene, Idaho—Work has been commenced on the new toll line of the Rocky Mountain Bell Tel. Co. between Sand Point and Bonners Ferry.

Olympia, Wash.—Residents of Piety Hill have organized a telephone company for the purpose of building a suburban line to connect with the local system. M. D. Abbott was elected president.

INCORPORATIONS.

San Francisco, Cal.—The California-Nevada Canal, Water & Power Co. has been incorporated here with a capital stock of $2,000,000, of which $500 has been subscribed by L. H. Sussman, J. Haber, Jr., and W. J. McLeon of San Francisco, Charles Elsey of Oakland and Joseph C. Love of Berkeley.

San Francisco, Cal.—The Stockton Gas & Electric Co. has filed a certified copy of its articles of incorporation in this city.

Los Angeles, Cal.—The Santa Catalina Scenic Railway Co. has been incorporated here with a capital stock of $100,000, of which $3,000 has been subscribed by F. Parker, Clair Tapan, John Coit, Peter Coit and Barbara Coit.

San Francisco, Cal.—The Star Oil Co. has filed a certified copy of its articles of incorporation in this city.

Antioch, Cal.—The local oil promoters are preparing to consolidate their interests and incorporate a company to operate their properties.

City of Mexico.—A company of Chihuahua business men has been incorporated under name of Compania Agricola y de Fuerza Electrica del Rio Conchos, with a capital of $1,000,000 to exploit electric power from falls of the Conchos river in the state. This company also proposes the construction of a $100,000 reservoir.

San Francisco, Cal.—The Electric Diamond White Water Co. has been incorporated here with a capital stock of $7,505 subscribed in full, as follows: J. C. Tice, $5,000; G. M. Dill, $1,250; D. C. Henderson, $5, and H. D. Overfield, $1,250.

Mexico, Mex.—The Rio Conchos Agricultural & Power Co. has been organized in Chihuahua with a capital stock of $100,000 to develop electric power and distribute it throughout an extensive territory. Paul Ginther of Santa Rosalia is at the head of the company.

Point Richomnd, Cal.—The Great Western Power Co. has filed articles of incorporation here. The company has a capital stock of $25,000,000. The incorporators are: Guy C. Earl of Oakland, W. H. Spaulding of Oakland, H. G. Young, E. A. Gowe, W. Stairley and L. D. Dimm of Point Richmond, F. D. Madison of San Rafael and B. C. Carroll of San Francisco.

Florence, Ariz.—The Pinal Water Co. has filed amended articles of incorporation here preparatory to engaging in extensive work.

FINANCIAL.

San Francisco, Cal.—The financial reports of the United Railroads of San Francisco for May, which have just been published, show that there was a decrease of $268,453 in gross earnings, as compared with the gross earnings for May, 1905, but, nevertheless, after the setting aside the pro rata for the interest and sinking fund charges, there was a small surplus.

San Francisco, Cal.—At a meeting of the board of directors of the Commercial Petroleum Co., held here a few days ago, an assessment of $1 per share was levied on the capital stock of the company. The works of the company are in Fresno county, but the main office is at 142 Steuart street, San Francisco.

OIL.

San Francisco, Cal.—The Union Oil Co. has completed extensive arrangements for the shipment of California petroleum to New York and other Eastern cities. John Baker, Jr., an officer of the company, who has just returned from Panama, states that a pipe line has been laid across the Isthmus of Panama equipped with three large tanks to permit of the transporting of oil received from and delivered to tank ships. The Lansing, a ship of 500,000 barrels capacity, is already in service, plying between California and the Isthmus. The Santa Maria and the Santa Rita will soon be in the same trade.

TRANSMISSION.

Redding, Cal.—Judge Elliston of Tehama county has decided that the Northern California Power Co. has no right to set poles for a power line along the highways of Tehama county without the consent of the adjacent property holders, notwithstanding the company is acting under a franchise granted by the Board of Supervisors.

Fresno, Cal.—The Joaquin Electric Co. will develop 12,500 horsepower in Crane Valley. Three contracts have been let for work on the plant. About 6,600 feet of tunneling will be required before the plant is completed.

Salt Lake, Utah.—C. L. Bailey and Edward T. Harviston of Roosevelt have asked for 150 second feet of water to be diverted from the Unitah fork of Green river, to be used in developing power to be distributed throughout the mines of that locality. The water will be diverted by means of a canal.

Salt Lake, Utah.—Lars Frandsen of Price has filed an application for the right to use the water flowing from Cottonwood Springs and Lost Springs. W. S. Woiler of Salt Lake has applied for the right to use the waters of Chicken and Redlick's creeks.

Redding, Cal.—J. A. Whitehead is preparing to build a power plant on or near Battle creek with a sufficient capacity to deliver 30,000 horsepower in San Francisco. Power will be generated by use of the water flowing in Battle creek. According to the plans, Mr. Whitehead and his associates will incorporate a company with a capital stock of $1,000,000.

Redding, Cal.—It is reported that the Northern Electric Power Co. has secured valuable water rights in the region of Montgomery creek, where a plant will be established for the generating of electric power.

Needles, Cal.—It is given out that work will shortly commence on the electric power plant of the desert water and power plant.

Salt Lake, Utah—Ernest I. Godbo of Salt Lake has asked for the right to use the flow of Coyote creek, in Fairfield county, to be used in generating electric power.

Monterey, Mex.—William J. Storms of Victoria, Tams., has applied to the government for a concession to establish a series of hydro-electric plants along the Rio Blanco in that state. He is now engaged in arranging the details of his plans. The government has granted a concession for such a plant to Messrs. Norcross and Taylor of Mexico City for the installation of a plant near Orizaba, Vera Cruz. Juan de Velasco and Carlos Bello of Mexico City are taking steps to install such a plant in the fall to transmit power to Atlixco. A concession has also been applied for by A. B. Adams of Mexico City to install a plant on the Balsas river near the town of Balsas. Alberto Robles Gil has petitioned for a concession to use the waters of the Conchos river in the state of Chihuahua for motive power. The water will be taken from the river near Las Vegas in the municipality of Coyame, District of Iturbide. C. Corvera has also petitioned for a concession to use the waters from the Precidio river, state of Sinaloa, for motive power for the use of the Union Cotton Factory at Villa Union. Mrs. Lorenza Ricard de Braniff has petitioned for a concession to use the waters of Antigua creek in the state of Vera Cruz in developing power. The Cia. Metalurgica Nacional of Matehuala, S. P. L., will develop about 500 horsepower by utilizing the power of various falls for mining operations.

Seattle, Wash.—The Hanford Irrigation & Power Co. is developing a large power, light and irrigation plant on Columbia river above the mouth of the Yakima river. It is estimated that enough power can be produced to develop 30,000 horsepower.

Port Townsend, Wash.—A company has been formed by Harry L. Tibbals, Jr., of this place, Wm. Andrews of Leland and others, to construct a power plant and supply electricity in Port Townsend. It has filed notice of appropriation of water rights on Little and Big Quilcene river.

TRANSPORTATION.

Redlands, Cal.—N. Buckmaster has made application for an electric railway franchise to the Grafton section. It is generally understood that the stockholders in the Home Gas & Electric Co. are interested in the new move.

Los Angeles, Cal.—The residents of New York street have raised the bonus of $10,000 demanded by the Los Angeles Railway Co. for a line along that street.

Phoenix, Ariz.—The Board of Supervisors has granted to S. S. Green and S. S. Scull a franchise for a single track electric railway from Phoenix to Glendale. No company has yet been incorporated to build the line.

Riverside, Cal.—A. C. Denman, Jr., has applied to the city trustees for an electric railway franchise over First street from Main to Colton avenue. This is the first step in the construction of the road between this place and Colton.

Pomona, Cal.—The representatives of the Huntington electric interests have asked for a street railway franchise through the town, and have agreed to build at least two miles of road within the city within four months.

Santa Ana, Cal.—The Huntington interests plan to build a power station here to be equipped with four transformers.

Los Angeles, Cal.—The Los Angeles Pacific Railway Co. is planning to four-track the greater portion of its lines.

San Diego, Cal.—As soon as work is completed of electricizing the N. C. & O. Railway, now in progress, steps will be taken to complete it to Tia Juana and up the Sweetwater Valley to La Presa.

Los Angeles, Cal.—A petition has been filed with the city clerk asking the council to grant a franchise to the Pasadena, Verdugo & San Fernando Railroad Co. for trackage through Griffith Park as part of the proposed line to connect Pasadena, Glendale and Hollywood with Los Angeles, which, it claims, will be a railroad of the first-class construction. Construction will begin within 60 days after granting of the franchise and be completed within two years. Backing the company are Adrian King of the Home Telephone Co., Marvin C. Marsh of the firm of Ramish & Marsh, W. L. Brent of the Merchants' Trust Co., and others.

City of Mexico.—The Compania Compradora de Metales de Mexico S. A., of which H. S. Houser is manager, is now seeking estimates on the cost of gravity cable trams. The people interested in the company are of Monterey.

Los Angeles, Cal.—H. E. Huntington will extend his Glendale Railway to Burbank, a distance of five miles from the present terminus of the Glendale line. Mr. Huntington plans eventually to extend through the San Fernando Valley.

Los Angeles, Cal.—H. E. Huntington is said to be planning the building of a trolley line to connect Mt. Lowe with Mt. Wilson, making of it an aerial balloon route.

Phoenix, Ariz.—S. S. Green and S. S. Scull of this city, who were recently given a franchise to construct an electric railway to Buckeye and Glendale, announce they will make application to the city council for a franchise that will grant them a right of way over some of the streets of the city to give them an outlet from the city toward Tempe and Mesa.

Riverside, Cal.—Bids will be received until November 8th for the sale of an electric railway franchise that will connect Riverside with San Bernardino and Redlands, application for which has been made by A. C. Denman, Jr., president of the San Bernardino Valley Traction Co.

San Pedro, Cal.—Major George S. Geis of Terminal states that he has been informed authoritatively that the electric road will be extended from Long Beach to Terminal within six months.

San Pedro de los Colonias Coah.—A new company, composed of Andres U. Medellin, Manuel Conzales and Vicente Garvia Fuentes, has been formed here for the purpose of installing a street car system in this town. The company is backed by American capital. Actual work of grading and track laying will begin within the next two weeks.

ILLUMINATION.

City of Mexico.—Lic Luis A. Vidaly Flor, as the representative of Edward Lawrence Doheny, Charles Albert Canfield and Norman Bridge, has petitioned the Department of Fomento for concession to establish a gas factory in the City of Mexico, and put through the republic, for heating, lighting and cooking.

Prescott, Ariz.—An ordinance has been adopted establishing a municipal electric lighting department and for the government and operation of same.

Sacramento, Cal.—It is understood that Sacramento capital is interested in a plan to establish an electric system in Reno to supply that place with light and power. F. A. Ross has been looking into the proposition.

Reno, Nev.—The Truckee River General Electric Co., which controls the Reno Light & Water Co., has completed plans for two more generating stations between Reno and Floriston.

Los Angeles, Cal.—The Edison Co. now has A. W. Childs and E. W. Boden at Rialto looking over the field with a view to extending the lighting system. It is planned to put in a new sub-station at Rialto.

WATER POWER.

F. H. Brownell has served notice in a number of condemnation proceedings in the Chelan county court, Washington, against riparian owners along the Chelan river between Chelan and Chelan Falls, where the Chelan Electric Co., recently organized at Everett, Wash., by J. T. McChesney and his associates, to develop water power for electrical purposes. It is announced that the company will supply the Great Northern Railway Co. with power to operate trains between Wenatchee and the Sound country, 160 miles, and light the various towns along the line.

N. C. Glover, assistant chief hydrographer of the United States Geological Survey, and J. S. Stevens, district hydrographer for Washington and Oregon, were in Spokane, Wash., recently, when the former said: "Power enough is annually wasted which, if developed and applied to industrial and commercial purposes, would make Washington an economic factor in the history of the country. But before such a move can be made it will first be necessary to make a systematic study of water supply, streams must be measured and a record of the daily flow for several years must be obtained. To neglect this opportunity will certainly be detrimental to the best interests of the state."

Los Angeles, Cal.—Thomas Ewing and Denver capitalists have contracted for an electric water supply for the mining camp of Vivian and adjacent regions in the Mojave desert mining country. Electric power for pumping water will be developed from the flow of the Colorado river, from which also the water will be pumped.

Oakland, Cal.—An ordinance has been passed by the city council appropriating $27,000 for the construction of work on a salt water pumping and distributing plant for fire protection.

Pasadena, Cal.—A mass meeting has been held in North Pasadena and resolutions passed advising the Pasadena administration to issue bonds for $50,000 for the immediate extension of the waterworks system in North Pasadena.

Orange, Cal.—The S. J. Smith Machinery Co. of Los Angeles has been awarded the contract for a new triplex pump to be put in the power house of the Orange City waterworks at $1,350.

Los Angeles, Cal.—Councilman George A. Smith of Los Angeles, Robert Montgomery, formerly owner of the Montgomery-Shoshone mine at Bullfrog, and Matt Hoveck have a 22-mile pipe line in course of construction on mining property in Inyo county, and it is expected to develop 75,000 horsepower within 60 days.

Goldfield, Nev.—A complete water system is contemplated for Camp of Wonders, a water company having incorporated.